The Canadian Medical Association Journal

Vol. 47 TORONTO, DECEMBER, 1942 No. 6

THE LOCAL TREATMENT OF BURNS WITH SULFADIAZINE SPRAY*

BY GEORGE J. COLOVIRAS, JR., *Royal Victoria Hospital, Montreal,*
W. T. WEST, F./L. No. 13 S.F.T.S., *St. Hubert, P.Q.,* AND
J. C. ARMOUR, *Royal Victoria Hospital, Montreal*

THE onrush of defense activities, even with improved industrial facilities and safeguards, has necessarily ushered in an increasing incidence of burns that are hospitalized. Recently we have been searching for a method of local treatment of burns of all degrees of depth and area which would reduce the incidence of complicating infection and the time of hospitalization and thereby minimize the loss of service of defence workers. A further requirement looked toward is ease of handling by relatively inexperienced persons.

Previous methods have been multitudinous and varied. Each method of treatment has advantages and disadvantages, the magnitude of either depending, among other things, on the experience and special methods of the worker with his own technique. The tannic acid method of Davidson[1] has been extensively utilized with indisputably good results. The exhaustive analysis of Glover and Sydow[2] compares it favourably with all other methods. From past experience, however, we feel that treatment with tannic acid has several disadvantages. Our main criticism is directed against the incidence of infection and the method of eschar formation, inevitably a rapid coagulum of precipitated surface proteins. The management of infections beneath the eschars has led to many differences of opinion. Glover and Sydow[2] immediately remove the eschar, whereas Murless[3] is convinced of the inadvisability of this procedure.

Because of the incidence of infection the appearance of the gentian violet treatment of Firor, introduced by Aldrich[4] in 1933, was favourably received. This method was introduced because of the effect of gentian violet in reducing the number of Gram-positive organisms infecting wounds. However, the importance of Gram-negative organisms as contaminants resulted in the use of a triple dye (gentian violet, brilliant green, and acriflavine).[5] Reports of variants of these methods of treatment soon appeared.[6, 7] In 1937 Branch[8] reported good results with gentian violet-silver nitrate eschar treatment. Other methods depending on osmotic dressings,[9] saturated sodium bicarbonate,[10] 10% sodium bicarbonate via Carrel tubes,[11] sterile horse serum plus cresol as preservative,[12] 5% aqueous ferric chloride,[13] glycerin-sulfonamide paste,[14] scarlet red bandages and moist sulfanilamide dressings,[15] sulfanilamide orally,[16] cod liver oil locally,[17] etc., demonstrate that it has been difficult to find a good, universal, easily managed treatment. This multiplicity of methods is bewildering to the clinical surgeon, who must select the treatment to be instituted locally in a given case.

In the past few years it has been customary at this hospital to use tannic acid or moist saline dressings in the treatment of burns. Such treatment has met with considerable success, although with some patients the burns have become infected. In some of these cases, skin grafting has had to be done some considerable time after the burn was received and the infection cured.

Having analyzed the advantages and disadvantages of these different treatments it was felt that only an eschar plus strong chemotherapeutic activity would offer an improved

* Pickrell treatment.

The Armour Surgical Service, Royal Victoria Hospital.

local treatment. At the end of June, 1941, Pickrell[18] reported on his use of sulfadiazine *m*-triethanolamine* spray in the treatment of burns as detailed below. This method seemed to possess several advantages over previous methods, mainly in the formation of the eschar and the availability of chemotherapeutic activity at the site of the burn surface where infection occurs.

Between June 25 and October 25, 1941, ten burn cases of varying severity have been treated in this hospital on this surgical service. Two cases were admitted between June 26th and July 7th and were treated with normal saline compresses as detailed below (Cases 1 and 2). On July 7th the first of eight cases was treated with the sulfadiazine spray as outlined below in the case reports (Cases 3 to 10). The percentage of surface involvement and depth follows the system as outlined by Berkow[19] and the American system of estimating depth of involvement (*i.e.*, (1) erythema, (2) vesicles, (3) loss of skin, (4) involvement of muscles).

In all these cases systemic treatment with plasma, etc., follows the system as outlined by Rose *et al.*,[20] Elman[21] and Black.[22] For further details on the general treatment of these patients over and above those outlined in the case reports see the complete report of Weil and Browne.[23]

CASE 1

No. 41-3009, S.B., aged 40. This patient was welding an alcohol tank with oxy-acetylene torches. The resultant explosion burned him over both arms and the back from the level of the crest of the ileum to the level of the neck. The face was burned in several places, but the deepest burns were on the fingers, forearms and arms—third degree. The remainder of the burns were 2nd degree, extending around and from the back laterally to the anterior axillary line on both sides. Extent of burn, 38%.[19] Temperature 99.2°, pulse 126, respirations 28.

The patient received morphia at the time of the accident and again six hours later when he arrived in the hospital from the industrial first-aid hospital. The hæmoglobin on arrival was 136% (14.5 = 100%), hæmatocrit 69, plasma proteins 6.7. Pooled plasma 3,750 c.c. and 5,250 c.c. of 5% glucose saline were given between June 26 and June 29. The hæmoglobin fell to 92% and the plasma proteins to 5.3. Between June 26 and July 5, 210 c.c. of cortin were administered intramuscularly. Sulfathiazole was given orally for several days (July 3 to 9) (July 31 to August 3). Total dosage was 51 grams. Saline compresses were placed and changed continuously. Management was difficult considering the extent of the burn. After about two weeks of saline compresses infection supervened (pyocyaneus) involving almost the whole of the burned surface. Liquid paraffin impregnated gauze treatment was instituted for a few days with little success. Saline compresses were then utilized again and the infection gradually brought under control. An impaired glucose tolerance curve was controlled with a course of insulin (10 units a.m. and p.m., August 2 to 31) which led to an improvement of the healing. On August 12 the right arm was pinch-grafted and the left was grafted on August 15 with numerous pinch grafts. On September 4 the left side of the back was grafted and the right side remains to be done in the near future. The patient's temperature has been of a septic spiking type for the past two months, rising on occasion to 102.6° and declining to 97.6°. In the past three weeks it has gradually returned to a normal level and stabilized. At present epithelialization is proceeding rapidly and the grafts have taken well. Hospitalization has been 74 days plus.

CASE 2

No. 41-3010, J.S. This patient (Figs. 1, 5 and 6) (with Case 1) was burned in an alcohol explosion. He was burned over the head with loss of hair as well as over the forehead, side of face, chin and neck. There was blistering on the posterior surface of the neck and the lips were burned 1st degree. The chest was burned anteriorly and posteriorly, 1st and 2nd degree, with spotty 3rd degree areas. The back was burned from the level of the lumbo-sacral notch to the back of the neck and laterally to the anterior part of the chest from the umbilicus upward. The arms and hands were swollen with 2nd and 3rd degree burns from the fingertips upwards to the shoulders. The estimated area burned was approximately 55%.[19] Temperature 98°, pulse 88, respirations 20.

Morphia sedation was instituted. Hæmoglobin 134% (14.5). Plasma proteins 7.37. Between June 26 when admitted and June 29

* *m* 2-sulfanilamidopyrimidine.

the patient had 4,250 c.c. of pooled plasma and 6,750 c.c. of 5% glucose saline intravenously, at the end of which time the hæmoglobin was 82% and the plasma proteins 4.7. Between June 26 and July 5 the patient received 200 c.c. of cortin intramuscularly. The subsequent course in the hospital necessitated transfusion five times (2½ litres of blood) because of anæmia. These were given (roughly) during the three weeks of hospitalization. Sulfathiazole was given in the course of hospitalization (June 28 to 30) (July 5 to 9) (July 11 to 17), total 47 grams. This does not include sulfathiazole (7½ grains in 100 c.c.) saline compresses applied from June 30 until July 20. A course of insulin (10 units a.m. and p.m., July 20 to September 7) was given because of an impaired glucose curve. Saline compresses were applied on arrival. Infection supervened (pyocyaneus) four days after arrival and sulfathiazole as outlined above was added to the compressing solution.

The patient's recovery was very slow. Pinch grafting was begun on July 1, at which time the right hand was grafted. On August 4 the left hand was pinch-grafted. On August 10 the left hand and chest was pinch-grafted, and on August 12 and August 14 the right chest and axilla and the left axilla. On August 16 the left axilla and arm were completed and on August 31 both upper arms were grafted. At present epithelialization is proceeding rapidly and the grafts are taking well. There is no infection at present. Hospitalization at present is 74 days plus, with indications of discharge from the hospital in the near future.

The Pickrell method[18, 24] was instituted at this hospital on July 6, 1941, utilizing a 3% aqueous sulfadiazine 8% triethanolamine solution. It has been our custom to institute shock therapy only when the hæmoglobin concentration is above 100% (14.5 grm = 100%). A narcotic is administered at once and the areas cleaned aseptically. To date we have not found it necessary to use anæsthesia in any of our cases. Vesicles and loose skin are removed and grossly contaminated areas (*i.e.* powder burns, grease and oil burns) are cleaned gently with tincture of green soap and water. Immediately thereafter the spray is applied every hour during the first 24 hours, every 2 hours during the second 24 hours, and every 3 hours during the third 24 hours. As a general rule we have noted that pain is immediately relieved after the first application of the spray, but for at least the first day of the spray the patients complain of a "stinging" sensation after the spray is applied, but do not complain of pain. Not all of the patients made this complaint. This sensation usually lasts about 15 minutes after the spray is applied. This method of spraying allows one to obtain a satisfactory, thin, translucent, pliable eschar, if such an eschar is desirable. Variability in thickness of the eschar is definitely of great advantage in covering surfaces, when desired, with a thin, translucent eschar rather than a thick, stiff covering.

The method of formation of the eschar is a solidification of the triethanolamine rather than a precipitation of surface proteins.

The importance of sterile management of these patients while the spray is being placed cannot be overemphasized. Sterile sheets should be placed under dependent parts, and a Balkan frame utilized for the suspension of extremities along with some method of heat (about 90° F.)[18, 24] to maintain the comfort of the patient as well as to aid in drying the burned areas between each application and also facilitating rapid eschar formation and decreasing the chances of infection beneath the new covering.

With the first four cases sulfadiazine tablets were not available for use orally. It was considered desirable to supplement the local treatment with oral administration of sulfadiazine, since blood levels in our cases declined rapidly after the first two days of spray. The determinations of blood sulfadiazine were done according to the method of Bratton and Marshall,[25] using a photoelectric cell and a 540 millimicron filter. This filter is not absolutely accurate, since maximum absorption is at 545 millimicrons[26] but the error is negligible for rough determinations. The amount of sulfadiazine given varied from case to case in an effort to improve on our technique with increasing experience.

CASE 3

No. 41-3339, M.L., aged 22. The patient was burned when the scaffolding on which he was standing gave way beneath him and he was dropped into a mixing machine containing hot asphalt and stone. This resulted in burns of 1st degree over the face, 2nd degree with vesicles behind both ears and large 1st and 2nd degree burns over the lower back at the base of the ribs extending on both sides of the mid

line. The right upper extremity showed extensive 2nd degree burns over the forearm and palm of the right hand. The left arm had a 2nd degree burn from just above the elbow to the fingertips with 3rd degree involvement over the thenar eminence. There were also 1st and 2nd degree burns of both ankles. The area involved was approximately 15%. Temperature 99°, pulse 70, respirations 20, blood pressure 128/90, hæmoglobin 98% (14.5 grm.).

The patient was cleaned of tar and oil with tincture of green soap and water. Vesicles and dead skin were removed. The spray was then applied for three days as outlined above. This patient complained a little of a stinging sensation for about 15 minutes after each application of spray the first day. Three days after the spray was begun the back burn and the posterior surface of the upper left arm had no eschar because of rubbing against the bed clothes and at this time there were signs of impending infection (culture was negative). Saline compresses were applied to these points and the vestiges of the eschar were floated off, revealing that the burns were in good condition with epithelialization proceeding well. Recovery was thereafter rapid and the patient was discharged in 12 days. Sulfadiazine was recovered in the blood at the end of the first four hours of spraying. Sixteen hours after admission the blood level was 3.45 mgm. %. In the next 20 hours it climbed still higher to 6.1 mgm. % and on the evening of the third day it had declined to 2.45 mgm. %. At no time were any toxic symptoms noted (*i.e.* nausea, urinary, blood or skin signs).

This case convinced us of the absolute necessity of devising methods of immobilization where dependent parts have suffered damage.

CASE 4

No. 41-3779, E.G., aged 22. On the day of admission this patient was burned with tracer powder in a munitions plant. There were burns of 2nd degree over the dorsal portion and the palmar aspect of the right thumb and index finger as well as 2nd degree burns over the dorsal aspect of four fingers. The estimated area burned was 6%. The burn was cleaned of powder, which had been driven into the skin, with tincture of green soap and water. Spray was applied as outlined. Morphia was given. Temperature 99°, pulse 82, respirations 20, blood pressure 130/84. Hæmoglobin 90% (14.5 grm.). About one week after the spray was applied the eschar began to curl and crumble at the edges of the burn revealing fresh, clean pink skin. Recovery was uneventful and the patient was discharged on the 19th day cured. Sulfadiazine levels were taken and the drug was recovered in four hours (trace). The highest level was reached just 24 hours after the spray was begun when it reached 4.1 mgm. %. There were no recognizable toxic symptoms.

CASE 5

No. 41-3997, J.C.C., aged 22. This patient's clothes caught fire while he was working as a helper in a boiler plant. Both legs were burned from the ankles well into the perineum on both sides, of 2nd and 3rd degree intensity. The left arm was burned 2nd and 3rd degree from just above the level of the elbow to the wrist. The area burned was approximately 30%. This patient was in the hospital twenty-four hours with no treatment other than saline compresses when we took charge of the case. We immediately cleaned away loose skin and vesicles, following with tincture of green soap and water. The left arm was easily immobilized on pillows and sterile towels while the spray was applied. The legs were immobilized apparently without contact with unsterile surfaces on Braun's splints. A cradle and lights were placed to aid in management as discussed above. Temperature 99°, pulse 100, respirations 20, blood pressure 100/70, hæmoglobin 106% (14.5 grm.).

Morphia sedation was instituted and a litre of pooled plasma was administered intravenously. The sulfadiazine blood level in eight hours was 4.2 mgm. %, gradually rising to a level of 17.1 mgm. % at the end of the third day. Five days after the eschar had been placed the perineal region of the left leg began to show signs of breaking down and shortly thereafter the right leg did likewise. Saline compresses were applied to float the eschar and on August 4 (11 days after admission) the legs were suspended with Kirschner wire through the heels in an attempt to prevent the spread of infection beneath the eschar. The field became more acutely infected, with the patient exhibiting a spiking septic temperature. Sulfathiazole was administered every four hours (total 66 grm.). Meanwhile the extensive burn of the left arm had almost completely healed.

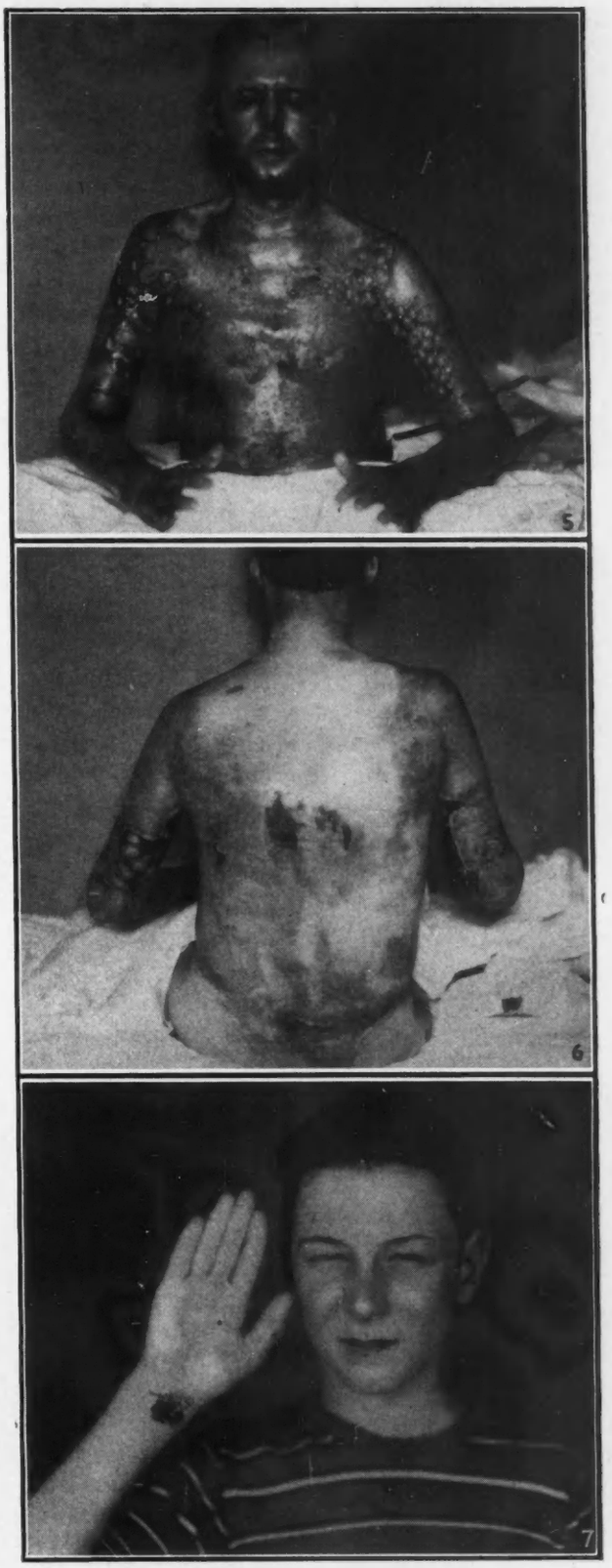
Fig. 1 *(upper left).* Case 2.—Treated with saline dressings showing granulation stage.
Fig. 2 *(lower left).* Case 9.—Treated with diazine spray showing the eschar *in situ.*
Fig. 3 *(upper right).* Case 9.—The result following the shedding of the diazine eschar.
Fig. 4 *(lower right).* Case 10.—Reapplication of diazine eschar to the face following removal by patient.

Two weeks later the legs were lowered and continuous saline dressings were continued with little success in clearing up the infection, composed of hæmolytic streptococci (Lancefield A), pseudomonas and *Staph. pyogenes.* Consequently on September 3 sulfadiazine-triethanolamine compresses were applied and at the same time sulfadiazine was given orally (grm. 2 at first, grm. 1 every four hours). In six days' time the infection was under control and the temperature had remained normal for 24 hours, the first time this had occurred in four weeks. We felt at this time that this rapid improvement had obviated the necessity for pinch grafting, inasmuch as epithelialization was proceeding well. A sulfadiazine blood level of approximately 10.1 mgm. % has been maintained since that time (12 days). Hospitalization has been 51 days plus. No toxic drug signs.

CASE 6

No. 41-4011, D.S., aged 34. The patient was burned with benzene, which ignited on his clothes, and his right leg received a 2nd degree burn from the ankle to the knee with scattered third degree areas over the leg. There were also 2nd degree burns on the back of the left hand as well as the fingers and thumb and a 1st-2nd degree burn of the palmar aspect of the left hand. There were 2nd degree burns on the inside of the right knee about 6 cm. in diameter as well as a 2nd degree burn of the nose and upper and lower lip. The area burned was approximately 8%. Temperature 99°, pulse 84, respirations 20, blood pressure 105/65, hæmoglobin 92% (14.5 grm.). The burn was cleaned with green soap and water and the areas sprayed as outlined above. The left hand was immobilized on pillows covered with sterile towels. A light was placed over the arm as outlined above. The left leg was placed in a Braun's splint and immobilized. The upper end of the burn came into contact with a supporting band of the splint frame before the eschar had dried and in five days there was evidence of impending infection (softening of the eschar). The agent was not isolated. The eschar was immediately floated off with saline compresses to reveal pink, healthy skin. Recovery was uneventful and the patient was discharged on the 22nd day.

Sulfadiazine levels were run and the drug was recovered as a trace at the end of four



Figs. 5 and 6. Case 2.—Following pinch grafting.

Fig. 7. Case 7.—The result following diazine eschar treatment of a burn of the face.

hours. At the end of 18 hours the level was 1.75 mgm. %. A level of 7.3 mgm. % was attained on the third day declining from this level. There were no recognizable signs of toxicity.

CASE 7

No. 41-4017, aged 12. This patient (Fig. 7) was burned by a bonfire when something exploded in the flames and burned him. He suffered 2nd and 3rd degree burns on the right hand and wrist but not involving the terminal phalanges of the right hand. The area burned included almost the whole of the face, 2nd degree. Area involved 6%. Temperature 98.2°, pulse 90, respirations 25, blood pressure 110/70. Hæmoglobin 82% (14.5 grm). The burn culture was negative. The carbon and dirt were cleaned from the wounds with green soap and water, with the spray applied as above. Lights and a cradle were placed, etc. Immobilization of the right upper extremity was carried out on pillows and sterile towels while spraying was applied. The face was sprayed completely. All burned areas were kept clear of contact with unsterile objects until the eschar had hardened and 15 days after admission the eschar had peeled off revealing healthy, pink skin and the patient was discharged, cured. Sulfadiazine was recovered in the blood four hours after spray was first applied. Level revealed a trace, rising in 24 hours to 1.45 mgm. % and up to 4.3 mgm. % on the third day. There were no recognizable signs of toxicity or damage to the eyes.

CASE 8

No. 41-4187, A.McN., aged 65. The patient, a chronic alcoholic, was burned by a fire started by a lighted cigarette in his bedclothes the night of admission. At the time of the fire the patient was in an alcoholic stupor. On admission he was found to have 3rd and 4th degree burns on the right leg from the ankle and dorsum of the foot to mid-thigh (with exposure of muscles and tendons in many places); 2nd and 3rd degree burns of the left leg medially extending from the left knee to the left ankle; 2nd degree burns of the palmar and dorsal aspect of the fingers of the right hand. The area burned was approximately 22%. Temperature 97°, pulse 88, respirations 28, blood pressure 200/130, hæmoglobin 92% (14.5 grm.).

An attempt was made to immobilize the leg (right) in a Braun's splint while spraying was carried out, but the patient was on the verge of delirium tremens and it was impossible to produce a well formed eschar. Attempts were made to keep him quiet with heavy doses of paraldehyde by rectum and other forms of sedation but in spite of this the patient got up and walked around the ward. As a result of the impossibility of keeping him immobilized while the eschar was forming some of the material was rubbed off the legs and they became infected. There was a heavy growth of *B. proteus, Staph. pyogenes* and diphtheroids. At this time saline compresses were applied and sulfathiazole was given orally (5 days after beginning treatment). Total given 78 grm. There was little improvement with this treatment. Thirty-five days after admission bacteriological culture revealed heavy *B. proteus* infection with a mixed overgrowth not isolated. Sulfadiazine-triethanolamine compresses were applied to the right lower extremity (the left had healed completely) and marked improvement was noted in two days. In the meantime all the other burned areas had healed completely. However, early in the morning of the 38th day the patient, who had appeared in good condition following transfusion the day before, screamed twice and died. A post-mortem examination was not done but the suspicion that death resulted from a pulmonary embolus (despite his toxic picture — spiking fever, etc.) seems well founded. Sulfadiazine level in four hours was 1.6 mgm. % rising rapidly until the evening of the 3rd day when it reached 16.2 mgm. % and began to decline. To the best of our knowledge there were no toxic reactions. Blood levels were not run when the compresses were applied because of the small quantity of drugs in the compresses.

CASE 9

No. 41-5260, E.G., aged 18. This patient (Figs. 2 and 3) had barely left the hospital after recovering from a previous burn (Case 4) when he was burned again by tracer powder. The arm, forearm and back of the right hand and fingers were burned to a depth of 2nd-3rd degree. Along an area of the right border of the chest just below the axilla and beginning at the posterior axillary line and extending one-half way to the spine there was a burn averaging 15 cm. in diameter. The area burned was approximately 13%. Temperature 98.3°, pulse 80, respirations 20, blood pressure 118/78,

hæmoglobin 98% (14.5 grm.). Morphia sedation was instituted and the burns cleared of powder particles, dirt and grease. The arm was immobilized on sterile towels, after cleaning with green soap and water and sprayed as outlined. Lights and a cradle were placed, etc. At the same time 2 grm. of sulfadiazine were given by mouth with a 1 grm. maintenance dose every four hours. Sulfadiazine was recovered in the blood in four hours (0.8 mgm. %) rising in three days to 9.7 mgm. % and declining slightly in the next seven days to 8.1 mgm. %. In nine days after admission the eschar began to peel and after 13 days only one-third of the eschar remained to come off. When the eschar was removed there was healthy, pink skin. There were no toxic symptoms.

CASE 10

No. 41-6393, D.W., 3 yrs. This patient (Fig. 4) was burned in an accident at home. She suffered burns of 1st and 2nd degree intensity of the whole of the face and neck. Area involved approximately 3%. Temperature 98.3°, pulse 100, respirations 25. The areas were cleaned with green soap and water after the vesicles and loose skin had been removed. Spray was applied as outlined. Sulfadiazine was given orally to a total of 8 grams over a period of 5 days. The eschar dried rapidly but three days after admission the child picked the eschar off the face and it was reapplied. However, there was no infection and the child was discharged on the 22nd day. The spray was applied with no particular care to miss the eyes although the scleræ were undamaged. There was no apparent danger in this procedure. There were no toxic drug symptoms.

DISCUSSION

Cases A, B, and C listed in the Table accompanying were cases treated with saline compresses just prior to our use of the sulfadiazine spray. As is shown there is little difference in the proportion of time spent in the hospital between the two treatments utilized.

We felt, after using both methods, that the sulfadiazine method of Pickrell was the easier to manage in the hospital. After the eschar is applied the patient might be allowed out of bed much more quickly than with other methods, because the worry over cracking of the eschar is considerably decreased, inasmuch as this eschar is soft and pliable yet strong enough to withstand the added strain of movement. This method does not bind granulating surfaces tightly, if at all, thereby causing constriction, as do other eschars, because it fits more loosely on the wound surface, being a hardening of the vehicle rather than a precipitation of surface proteins.

TABLE I.

Method of treatment		*Area involved*	*Depth*	*Days in hospital*
SALINE				
Case A.	A.C.	4.5%	2	45
B.	J.H.	38.0	2-3	32
C.	R.L.	20.0	2	20
1.	S.B.	38.0	2-3-4	74 plus
2.	J.S.	55.0	2-3-4	74 plus
SULFADIAZINE				
3.	M.L.	15.0	2-3	12
4.	E.G.	6.0	2	19
5.	J.C.C.	30.0	2-3-4	51 plus
6.	D.S.	8.0	2-3	22
7.	J.H.	6.0	2	15
8.	A.McC.	22.0	3-4	38 (died)
9.	E.G.	13.0	2-3	18
10.	D.W.	3.0	1-2	22

The endless, time-wasting process of applying fresh saline compresses diverts the attention of the nursing staff from other duties. This labour is obviated with the diazine treatment. Those cases in which infection necessitated the removal of the eschar were analyzed and we feel that the many mistakes in management we made at first could have been avoided. With Case 3, we would certainly have had better results, probably without infection, had we used sterile sheets or placed the patient on his side or face until the eschar had dried. It healed immediately when the contaminating surfaces were removed. Cases 5 and 6 were excellent examples of instances where suspension of extremities would most certainly have prevented the occurrence of infection, since both infections originated at the point of contact with unsterile surfaces. Case 5 demonstrated the extreme difficulty of managing perineal burns but it also demonstrated the efficiency of the diazine solution (as compresses) in clearing up an infected area and doing it quickly.

Case 8 is obviously that of a patient presenting a combination of factors difficult to manage by any method, but here again the diazine compresses seemed to clear away infection in a very short time. Our bacteriological reports have convinced us that this spray is of definite value in combating Gram-positive and Gram-negative

organisms commonly found infecting burn surfaces without, at the same time, damaging tissues. Cases 7 and 10 demonstrate the ease with which face burns can be managed with this treatment whereas other eschar methods are rarely, if ever, used in the treatment of burns of the face. Our face burns showed no residual effects after the eschars had peeled off and there was no damage to ocular tissues as a result of the liquid spray getting into the eyes themselves.

Comparison of the cases treated with saline compresses and those treated with sulfadiazine spray shows that all those treated with saline were infected, whereas of the spray-treated patients four apparently had no infection, two had minor signs and two were out and out nursing problems, albeit infected.

From our results it would seem that a spray containing an agent facilitating rapid drying of the eschar would be the solution, in part, of the nursing problems. The rapid formation of an eschar might possibly interfere with the desired effect of the sulfadiazine but, if by some means the loss of chemotherapeutic effect could be minimized, then the aid to patient nursing care would be extremely advantageous. The presence of a quicker drying eschar would prevent any immobilization such as was necessary in the case of our patients and would also minimize the danger of rubbing the drug from the burned area and of allowing infection to rapidly supervene, as was the case in two of our patients.

With the high blood levels of sulfadiazine that were obtained in the blood stream, the possibility of toxic reactions would not seem to be remote. In our series of eight cases we had no toxic reaction that could be recognized. Blood studies and urinalyses were run routinely on these cases with consistently negative results. We had no case of nausea or vomiting, no case of rash or jaundice as mentioned by other authors.[27, 28, 29] Our levels on maintenance dose correspond roughly with the results as obtained by other workers.[27, 28, 29]

CONCLUSIONS

A. *Advantages of the method:*

1. The diazine spray has a high chemotherapeutic activity against both Gram-positive and Gram-negative organisms commonly infecting burns.

2. Ease of management is a conspicuous feature of the method.

3. Pain is relieved early in the treatment (15 minutes).

4. The eschar, a solidification of the vehicle rather than a precipitation of surface proteins, can be adjusted to any depth by varying the amount of spray applied, and the resultant eschar is soft, pliable, translucent, and not easily cracked.

5. Its use in burns of the face is not contraindicated in the least.

6. There is a low toxicity with use of the drug.

7. As a result the length of hospitalization might be shortened.

B. *Disadvantages of the method:*

1. The eschar is relatively slowly formed.

2. Possible toxic reaction with use of the drug in cases involving large areas of body surface.

3. As with other eschar methods of treatment grafting is impeded.

REFERENCES

1. DAVIDSON, E. C.: *Surg., Gyn. & Obst.*, 1925, **41**: 302.
2. GLOVER, D. M. AND SYDOW, A. F.: *Am. J. Surg.*, 1941, **51**: 601.
3. MURLESS, B. C.: *Brit. M. J.*, 1940, **1**: 51.
4. ALDRICH, R. H.: *New Eng. M. J.*, 1933, **208**: 299.
5. *Idem*: *New Eng. M. J.*, 1937, **217**: 911.
6. PENICK, R. M.: *Int. Clinics*, 1933, **1**: 31.
7. CONNELL, J. H. *et al.*: *J. Am. M. Ass.*, 1933, **100**: 1219.
8. BRANCH, H. E.: *Arch. Surg.*, 1937, **35**: 478.
9. WILSON, W. R.: *Brit. M. J.*, 1927, **1**: 54.
10. ROBERTSON, B. AND BOYD, G.: *Am. J. Dis. Child.*, 1923, **25**: 163.
11. GOLDBLATT, D.: *Ann. Surg.*, 1927, **85**: 410.
12. MONTEITH, S. R. AND CLOCK, R. O.: *J. Am. M. Ass.*, 1929, **92**: 1173.
13. COAN, G. L.: *Surg., Gyn. & Obst.*, 1935, **61**: 687.
14. ROBSON, J. M. AND WALLACE, A. B.: *Brit. M. J.*, 1941, **1**: 469.
15. GOWER, W. E.: *Iowa State Med. Soc.*, 1941, **31**: 234.
16. GRIGSBY, B. C.: *Virginia Med. Monthly*, 1940, **67**: 306.
17. HARDIN, P. C.: *South. Surg.*, 1941, **10**: 301.
18. PICKRELL, K. L.: Personal communication.
19. BERKOW, S. G.: *Arch. Surg.*, 1924, **8**: 138.
20. ROSE, B. *et al.*: *Canad. M. Ass. J.*, 1941, **44**: 442.
21. ELMAN, R.: *J. Am. M. Ass.*, 1941, **116**: 213.
22. BLACK, D. A. K.: *Brit. M. J.*, 1940, **2**: 693.
23. WEIL, P. G. AND BROWNE, J. S. L.: Forthcoming publication.
24. PICKRELL, K. L.: *Johns Hopkins Hosp. Bull.*, 1941, **69**: 217.
25. BRATTON, A. C. AND MARSHALL, E. K.: *J. Biol. Chem.*, 1939, **128**: 537.
26. FEINSTONE, W. H. *et al.*: *Johns Hopkins Hosp. Bull.*, 1940, **67**: 429.
27. PETERSON, O. L. *et al.*: *Am. J. M. Sc.*, 1941, **201**: 357.
28. REINHOLD *et al.*: *Am. J. M. Sc.*, 1941, **201**: 106.
29. FLIPPIN, H. F. *et al.*: *Am. J. M. Sc.*, 1941, **201**: 585.

RÉSUMÉ

Les vaporisations de *m* 2-sulfanilamidopyrimidine remplaceront les anciens traitements par l'acide tannique, le violet de gentiane, les compresses humides de sérum et tous les autres procédés similaires. La sulfadiazine ainsi vaporisée a un pouvoir bactéricide élevé sur les organismes Gram-positifs et Gram-négatifs qui infectent habituellement les brûlures. Le maniement des malades est grandement simplifié et la douleur est soulagée dès les premières minutes. L'escarre, qui se forme aux dépens de la triéthalonamine plutôt que par la précipitation des protéines superficielles, est molle, flexible, translucide et difficile à faire craquer. La toxicité du produit est minime. Le traitement est d'application facile et abrège les séjour à l'hôpital. On peut reprocher à la méthode la lenteur de formation de l'escarre et la possibilité d'intoxication par l'agent thérapeutique.

JEAN SAUCIER

PRODUCTION OF NEPHROSCLEROSIS BY OVERDOSAGE WITH DESOXYCORTICOSTERONE ACETATE*

BY HANS SELYE

Montreal

THE observation that testoid hormones, especially testosterone and its close derivatives, exert a renotropic action in the mouse and rat[1-5] led to similar investigations with other steroid compounds, and it was found that desoxycorticosterone acetate (D.C.A.) also exhibits a kidney-enlarging effect.[4, 6] This work has been confirmed and extended by several investigators.[7, 8, 9] All these observations indicated that, although the steroids cause hypertrophy of the parietal layer of Bowman's capsule in some species (*e.g.* the mouse), they do not elicit any detectable change in the glomerular capillaries or in the visceral lamina of Bowman's capsule. The resulting kidney enlargement is mainly due to a hypertrophy of the epithelial cells forming the proximal and distal convoluted tubules.

It was rather surprising to find, therefore, in a preliminary experiment on chicks that in this species marked glomerular changes accompany the renal enlargement produced by D.C.A. overdosage. There is epithelial proliferation and hyalinization of the tuft capillaries, roughly speaking, a picture generally associated with chronic glomerulonephritis or nephrosclerosis. The similarity to these latter clinical conditions showed itself also by the development of a conspicuous cardiac hypertrophy, the accumulation of fluid in the serous cavities, decrease in blood hæmoglobin, etc.

In his now classical experiments Goldblatt[10, 11] proved that renal ischæmia may cause hypertension. This finding inspired numerous other workers and was the main stimulus for the recent progress in the elucidation of the part played by the kidney in the production of blood pressure regulating substances. However, it is not probable that constriction of the kidney arteries could account for the development of hypertension in all, or even in the majority of the clinical cases observed, since at autopsy such a constriction is frequently not demonstrable.

Nephrosclerosis with hypertensive heart disease is the most frequent cause of death. It is, therefore, of great importance to elucidate the pathogenesis of this condition as far as possible. In an effort to add something to our understanding of this disease, a detailed study of its production by D.C.A. was made, and it is on these experiments that I should like to report here.

First, it must be emphasized, however, that in adrenalectomized dogs Cleghorn *et al.*[12] observed cardiac irregularities during treatment with D.C.A. In rats necrosis of myocardial fibres and their replacement by fibroblasts have been noted following D.C.A. treatment.[16] Furthermore, several investigators warned of the danger of D.C.A. overdosage in Addisonian patients because such therapy may result in marked tissue œdema, dilatation of the heart, and cardiac insufficiency.[13, 14, 15] These changes have generally been considered to be secondary to the effect of this compound on electrolyte metabolism and blood volume. It is quite possible, however, that renal changes might have played a part in their pathogenesis, since morphological studies on the kidneys of these patients have not been carried out as yet.

EXPERIMENTAL

Twelve three-day old single-combed, white, Leghorn chicks were treated with subcutaneous injections of 0.5 mgm. of D.C.A. in 0.05 c.c. of peanut oil twice daily, while 12 similar chicks were used as controls and received 0.5 mgm. of cholesterol (a pharmacologically inert steroid) in the same amount of peanut oil administered in the same manner. Both groups were fed exclusively on "Purina chick startena", a food preparation (sold by the Ralston Purina Company, Ltd. of Montreal) which according to this firm contains about 18% protein, 4% fat and 7% crude fibre. They also received water *ad lib.*

After about 10 days it became evident that the D.C.A.-treated birds consumed much more water than the controls and that they developed some tissue œdema. On the 20th day of the experiment 6 birds in each series were killed.

* From the Department of Anatomy, McGill University, Montreal.

The organs of the cholesterol birds were normal, but in the D.C.A.-treated group the following changes were noted.

There were signs of *fluid retention*. The abdominal cavity was filled with ascitic fluid, a change which we[17] also found to occur in D.C.A.-treated rats. The pericardium was likewise distended with fluid. The subcutaneous tissue was definitely œdematous, especially the loose connective tissue around the neck and in the retroperitoneal space. The testes in two of the three male birds, as well as the ovary in two of the three females of this series, showed considerable distension due to the accumulation of enormous quantities of fluid. In the cockerels most of this fluid proved to be within the seminiferous tubules which, upon histological examination, were seen to have transformed themselves into wide fluid-filled spaces lined by a single layer of flat epithelial cells. The typical stratified seminiferous epithelium had vanished.

The *heart*, especially the left ventricle, was greatly enlarged and increased in weight (Figs. 1 to 4). Upon histological examination it was found that this enlargement was due in part to cardiac dilatation but in part also to actual hypertrophy of the individual muscle fibres (Figs. 5 to 7). The nuclei were likewise increased in size and more rounded and vesicular than those of normal heart muscle. The enlargement was especially obvious in the Purkinje fibres of the conduction system. Between the muscle fibres there was a varying degree of round-cell infiltration and some œdema. These cardiac changes suggested a clinical examination of the six surviving birds and it was found that these exhibited a gasping, strained type of breathing, some bradycardia, and a certain degree of cyanosis, indicating a circulatory disturbance. However, the pulse remained regular and was indeed stronger than in the controls.

The *vessels*, especially the aorta and its main branches, were thickened. This, upon histological examination, proved to be due to an increase in the fibrous tissue of the vessel walls, while the smooth muscle fibres appeared compressed and actually thinner than in the controls (Figs 9 and 10). It was also quite evident at autopsy that the cardiac vessels were considerably dilated. Since we have not as yet succeeded in devising a suitable apparatus for the accurate measurement of the blood pressure in the non-anæsthetized chick, we were forced to use a direct method, inserting a needle into the common carotid and connecting it with a mercury manometer. The blood pressure was thus determined in the six experimental and six control surviving chicks and, although some showed a rise, the difference was not statistically significant, so that this aspect of the question will have to be re-investigated.

The *kidney* exhibited the aspect of the "large white kidney". The renal weight was considerably above normal and the kidney tissue appeared greyish and swollen (Figs. 11 and 12). Under the microscope the tubules proved to have a greatly distended lumen, the epithelial cells in all segments of the nephron from the proximal convoluted tubules to the collecting tubules, were increased in size and displayed "cloudy swelling". Both the parietal and visceral lamina of Bowman's capsule showed signs of hypertrophy and hyperplasia (Figs. 13 to 15). Mitotic figures were readily detectable in the epithelial cells of the visceral lamina in many glomeruli (Fig. 16). The entire kidney parenchyma showed marked hyperæmia, and this was especially obvious in some of the glomeruli, which were enormously enlarged in comparison with the normal controls.

Other glomeruli were comparatively small and revealed obvious signs of sclerosis. Between the endothelium of the tuft capillaries and the visceral lamina of Bowman's capsule a homogeneous thick layer of hyalinized connective tissue became very obvious, especially in sections stained with Masson's trichrome stain (Fig. 17). In those tufts in which this process of hyalinization was most developed the capillaries were completely obliterated. As a result of the proliferation of the two laminæ of Bowman's capsule the glomerular space was frequently filled out with epithelial cells. These epithelial proliferations were in many instances subdivided by numerous intercommunicating canaliculi, just as in the chronic glomerulonephritis of human patients. Typical "epithelial crescents" were rare because in the chick most of the epithelial proliferation occurred uniformly around the whole circumference of the parietal layer of Bowman's capsule. The glomerular space was almost invariably enlarged and frequently filled with cellular débris. In young chicks the kidney tissue immediately underneath the capsule consists of fetal, undeveloped nephrons. These proved to have undergone partial maturation, probably in an effort to compensate for the destroyed renal tissue.

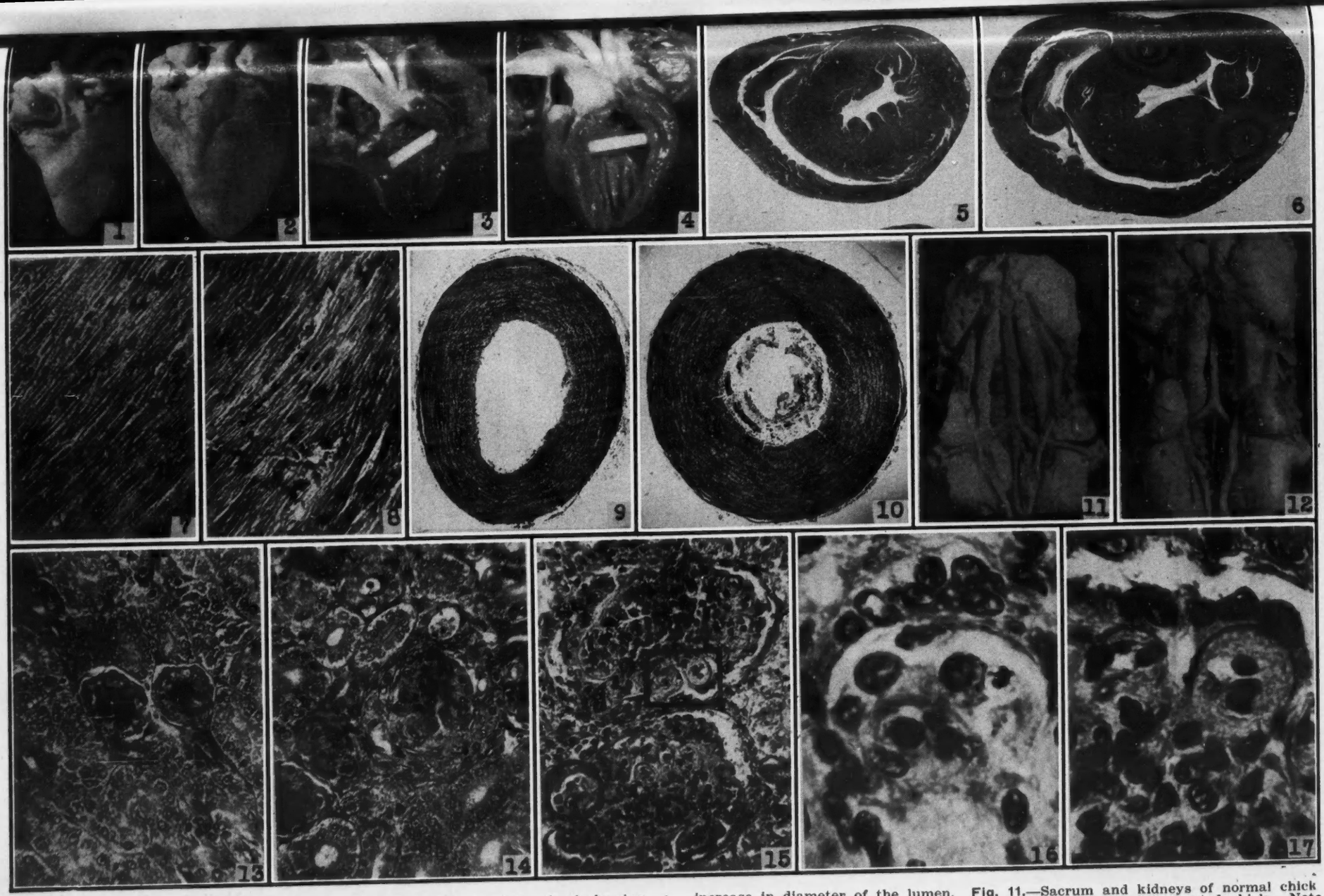


Fig. 1.—Heart of normal chick. **Fig. 2.**—Heart of D.C.A.-treated animal showing marked increase in size. **Fig. 3.**—Heart of normal chick *in situ* with left ventricle and aorta opened to show thickness of wall. **Fig. 4.**—Heart of D.C.A.-treated chick dissected as in Fig. 3. Note increased thickness of myocardium and especially of papillary muscles as well as the thickening of aortic wall. **Fig. 5.**—Low magnification of cross-section through ventricles of normal chick. **Fig. 6.**—Section through ventricles of D.C.A.-treated chick at same level and under same magnification as in Fig. 5. Note increased thickness of muscular wall. **Fig. 7.**—High magnification of myocardial fibres in normal chick. Note thinness of fibres and elongated rod-like nuclei. **Fig. 8.**—Myocardial fibres of D.C.A.-treated chick from same region and under same magnification as in Fig. 7. Note increased thickness of fibres and rounded enlarged nuclei. **Fig. 9.**—Cross-section through aorta of normal chick. **Fig. 10.**—Cross-section through aorta of D.C.A.-treated chick. Note increase in thickness of wall unaccompanied by increase in diameter of the lumen. **Fig. 11.**—Sacrum and kidneys of normal chick **Fig. 12.**—Same dissection as in Fig. 11 but taken from D.C.A.-treated chick. Note great enlargement of the kidneys with rounding of their edges. The upper part of the aorta is almost completely covered by the proliferating renal tissue. **Fig. 13.**—Two glomeruli in kidney of normal chick. Same magnification as Figs. 14 and 15. **Fig. 14.**—Marked epithelial proliferation in both laminæ of Bowman's capsule in D.C.A.-treated chick. **Fig. 15.**—Two greatly enlarged glomeruli with hyalinized tuft capillaries in D.C.A.-treated chick. **Fig. 16.**—Oil immersion microphotograph of encircled area from Fig. 15. Note epithelial cell in visceral lamina of Bowman's capsule undergoing mitosis. **Fig. 17.**—Oil immersion microphotograph of the area in the square of Fig. 15. Note enormously thickened hyalinized capillary wall between endothelium and visceral lamina of Bowman's capsule epithelium.

The six surviving experimental chicks, as well as the six cholesterol controls, were used for blood chemical analysis on the day following the autopsy of the above-mentioned birds. It was found that the *non-protein nitrogen* (Folin and Wu method modified for Evelyn's photoelectric colorimeter) was not raised by the D.C.A. treatment in spite of the pronounced renal lesions. This was not unexpected since many of the glomeruli were still permeable, and, indeed, showed compensatory enlargement.

The *blood chlorides* (van Slyke's method on whole blood) were actually somewhat higher in the D.C.A.-treated than in the control birds. This was surprising in view of the fact that in mammals D.C.A. decreases the chloride concentration of blood.[18] Although the increase in the present group may not be significant it is difficult to understand why the chick, unlike the rat, fails to respond to D.C.A. overdosage by the development of hypochloræmia.

The *blood hæmoglobin* content (photoelectric determination with the Evelyn colorimeter) was significantly decreased under the influence of D.C.A. This may be interpreted as a sign of true anæmia but could also be regarded as secondary to an increase in plasma volume since blood volume determinations have not been attempted.

The *blood sugar* (Schaffer-Hartmann-Somogyi method) was definitely increased in the D.C.A. treated group. This also is unexpected since, unlike other corticoids (*e.g.* corticosterone or compound "E"), D.C.A. is devoid of carbohydrate activity as judged by observations on mammals. It must be emphasized that owing to the poor condition of the treated animals it was felt that they could not stand fasting, hence all these values refer to observations on fed birds.

Table I summarizes our results. It will be kept in mind that the six animals used for morphological studies represent a separate group from the six in which the blood chemical determinations were made although the treatment was the same in both instances.

DISCUSSION

The above experiments indicate that in the baby chick D.C.A.-overdosage elicits typical glomerular lesions similar to those seen in human nephrosclerosis. The cardiovascular changes are also of the type characteristic of the latter condition. However, the tubular changes and the marked œdema and ascites are more reminiscent of the acute nephrotic type of renal lesion.

The action of D.C.A. in the chick is undoubtedly specific, since similar changes were not observed in the cholesterol-treated controls, nor in a group of 120 additional chicks of the same hatching some of which were treated with other steroids (œstradiol, methyl testosterone, pregnenolone, Δ^4-androstenedione, progesterone, ethinyl testosterone, dehydro-*iso*-androsterone), while others remained entirely untreated. It is difficult to explain, however, why the renal lesions produced by D.C.A. in mammals leave the glomeruli intact, while in the present experimental series the glomerular changes were so conspicuous.

It is possible that we are merely dealing with a species difference, the chick being much more sensitive than the mammal. It is more probable,

TABLE I.

COMPARISON OF ORGAN WEIGHTS AND BLOOD CHEMICAL DATA IN DESOXYCORTICOSTERONE ACETATE AND IN CHOLESTEROL TREATED (CONTROL) CHICKS

Treatment	*Desoxycorticosterone acetate*							*Cholesterol*						
No. of animals	*1*	*2*	*3*	*4*	*5*	*6*	*Average*	*1*	*2*	*3*	*4*	*5*	*6*	*Average*
Initial body weight in grm..	40	42	40	43	41	42	*41*	43	41	40	42	40	42	*41*
Final body weight in grm..	135	165	110	100	120	140	*130*	150	130	90	90	100	110	*112*
Kidney weight in grm.....	2.414	2.453	3.346	1.816	1.438	1.769	*2.206*	1.858	1.760	1.123	0.992	1.243	1.398	*1.396*
Heart weight in grm.....	1.768	1.918	1.558	1.103	1.539	1.937	*1.637*	0.854	0.890	0.623	0.642	0.718	0.894	*0.760*
Blood chlorides in mgm./100 c.c.....	574	550	561	515	526	561	*548*	515	503	515	526	515	539	*519*
Blood sugar in mgm./100 c.c.....	248	190	182	178	166	182	*191*	154	190	149	149	174	..	*160*
Blood hæmoglobin in grm./100 c.c.....	7.0	7.0	7.25	7.5	7.25	6.0	*7.0*	9.5	9.8	8.05	9.5	8.65	8.45	*8.99*
Blood non-protein-nitrogen in mgm./100 c.c.....	54	39	45	36	35	46	*42.5*	40	39	40	41	52	46	*43*

however, that some additional factor became effective in this experiment which was absent in our previous work on mammals. Thus the diet used in this experimental series was different from that employed in our experiments on the mouse and rat. It is possible that D.C.A. does not act in this manner except on certain diets. Experiments now under way are planned to show whether such glomerular changes can be produced by D.C.A. in mammals if they are given the diet used in the chick. It is noteworthy that œdema and cardiac changes of the type described in this experimental series have previously been obtained on thiamine-deficient diets. It will hence have to be shown whether D.C.A. could elicit this syndrome in mammals on a comparatively thiamine-deficient food ration, and whether excess thiamine could prevent it in the D.C.A. treated chick. It will be borne in mind that cardiac dilatation and œdema are more prone to occur in patients treated with D.C.A. if these are simultaneously given much sodium chloride.

All these factors will require further investigation. The present communication is merely designed to show that a corticoid hormone can produce nephrosclerosis. This fact should be kept in mind by the physician, not only as a warning against overdosage with corticoids but also as a possible lead for the explanation of the pathogenesis of nephrosclerosis and essential hypertension. Continuous strain has often been regarded as a fact in the production of this disease. Similarly, many damaging agents have the property of increasing the size and hormone production of the adrenals.[19] It has also been demonstrated that adrenal cortical tumours are frequently accompanied by a rise in blood pressure and that after extirpation of the tumour the blood pressure returns to normal.[20, 21] Hence it is perhaps not too far fetched to suspect adreno-cortical involvement as a causative agent in nephrosclerotic hypertension.

SUMMARY

Experiments on young chicks indicate that overdosage with desoxycorticosterone acetate may produce typical nephrosclerosis accompanied by cardiac dilatation and hypertrophy, tissue œdema, ascites, and pericardial fluid accumulation. These observations are discussed in connection with the pathogenesis of nephrosclerotic hypertension in man.

The expenses of this investigation were defrayed through a grant received from the DesBergers-Bismol Laboratories of Montreal. The desoxycorticosterone acetate was kindly supplied by Dr. E. Schwenk, of the Schering Corporation of Bloomfield, New Jersey. The author is especially indebted to Miss Helen Stone without whose untiring technical assistance this work could not have been completed.

REFERENCES

1. SELYE, H.: Morphological changes in female mice receiving large doses of testosterone, *J. Endocrinol.*, 1939, **1**: 208.
2. *Idem*: The effect of testosterone on the kidney, *J. Urol.*, 1939, **42**: 637.
3. *Idem*: The effect of testosterone on the kidney and on the general condition of uræmic animals, *Canad. M. Ass. J.*, 1940, **42**: 188.
4. *Idem*: In eractions between various steroid hormones, *Canad. M. Ass. J.*, 1940, **42**: 113.
5. *Idem*: Effect of hypophysectomy on the morphological appearance of the kidney and on the renotropic action of steroid hormones, *J. Urol.*, 1941, **46**: 110.
6. *Idem*: Variations in organ size caused by chronic treatment with adrenal cortical compounds. An example of a dissociated adaptation to a hormone, *J. Anat.*, 1941, **76**: 94.
7. LUDDEN, J. B., KRUEGER, E. AND WRIGHT, I. S.: Effect of testos erone propionate, œstradiol benzoate, and desoxycorticosterone acetate on the kidneys of adult rats, *Endocrinology*, 1941, **28**: 619.
8. KORENCHVESKY, V. AND HALL, K.: Correlation between sex hormones, thyroid hormones, and desoxycorticosterone as judged by their effects on the weights of organs of gonadectomized rats, *Biochem. J.*, 1941, **35**: 726.
9. DURLACHER, S. H., DARROW, D. C. AND WINTERNITZ, M. C.: The effect of low potassium diet and of desoxycorticosterone acetate upon renal size, *Am. J. Physiol.*, 1942, **136**: 346.
10. GOLDBLATT, H.: Studies on experimental hypertension; pathogenesis of experimental hypertension due to renal ischæmia, *Ann. Intern. Med.*, 1937, **11**: 69.
11. *Idem*: Studies on experimental hypertension; production of persistent hypertension in monkeys (macaque) by renal ischæmia, *J. Exper. Med.*, 1937, **65**: 671.
12. CLEGHORN, R. A., FOWLER, L. A., WENZEL, J. S. AND CLARKE, A. P. W.: The desoxycorticosterone acetate requirement of the adrenalectomized dog, *Endocrinology*, 1941, **29**: 535.
13. FERREBEE, J. W., RAGAN, C., ATCHLEY, D. W. AND LOEB, R. F.: Desoxycorticosterone esters. Certain effects in the treatment of Addison's disease, *J. Am. M. Ass.*, 1939, **113**: 1725.
14. WILLSON, D. M., RYNEARSON, E. H. AND DRY, T. J.: Determinations of the blood platelets during traumatic shock: an experimental study, *Proc. Staff Meet. Mayo Clin.*, 1941, **16**: 161.
15. MCGAVACK, T. H.: Adrenal insufficiency. Some pitfalls in the treatment of Addison's disease, *J. Clin. Endocrinol.*, 1941, **1**: 68.
16. DARROW, D. C. AND MILLER, H. C.: Production of cardiac lesions by repeated injections of desoxycorticosterone acetate, *J. Clin. Invest.*, 1942, **21**: 601.
17. SELYE, H. AND FRIEDMAN, S. M.: The action of various steroid hormones on the ovary, *Endocrinology*, 1940, **27**: 857.
18. SELYE, H. AND DOSNE, C.: Changes produced by desoxycorticosterone overdosage in the rat, *Proc. Soc. Exper. Biol. & Med.*, 1940, **44**: 165.
19. SELYE, H.: The alarm reaction,, *Cyclopedia of Med.*, 1940, **15**: 15.
20. MURRAY, C. G. AND SIMPSON, G. S.: Virilism due to an adrenal cortical nephroma, *The Lancet*, 1927, p. 745.
21. WALTERS, W., WILDER, R. M. AND KEPLER, E. J.: The suprarenal cortical syndrome: Report of two cases with successful surgical treatment, *Proc. Staff Meet. Mayo Clin.*, 1934, **9**: 400.

SUCCESSFUL REMOVAL OF A SACRAL PARASITIC FETUS

BY JESSIE GRAY, M.S., F.R.C.S.(C)

Toronto

ON March 7, 1942, at the Women's College Hospital a seven months' male baby was delivered by Dr. Marion Kerr which presented a large parasitic fetus attached across the buttocks.

Prior to the delivery an x-ray had been taken of the mother because the obstetrician thought she could feel two fetal heads. This prenatal x-ray is shown in Fig. 1 and no interpretation was placed upon the area of density beneath the mother's left costal margin. The mother had a moderately severe pre-eclamptic toxæmia, and labour was induced.

The baby presented as a vertex and the delivery was accomplished with difficulty only in extracting the after-coming body, due to the presence of the mass. The baby was in good condition, cried well and was of good colour. The combined weight of the baby and tumour was six pounds.

The mass was attached to the anococcygeal region by a wide pedicle which seemed to displace the anus anteriorly from the coccyx posteriorly. With the little finger in the anus the baby's rectum did not seem to have any communication with the mass. Nor did the tumour vary in size when the child cried or strained. The tumour itself was larger than the baby's head, lobulated but almost round in shape and covered by skin, except at one spot where a circular opening a little over an inch in diameter revealed what appeared to be blood clot within. From this opening a steady oozing of blood occurred. On palpation the mass was of fleshy consistency with distinct bony elements in certain parts and what felt somewhat like a spinal column along one side. There did not appear to be any skeletal connection between the baby and the tumour so far as palpation was concerned.

Twenty-four hours were allowed to elapse, to ascertain the viability of the skin of the pedicle of the tumour and to allow the baby to become more acclimatized to his new environment. During this interval the child's temperature and heart rate were carefully watched for signs of sepsis or excessive bleeding. Such signs did not appear.

On the day following delivery the skin of the tumour showed a bluish discoloration of impending gangrene but about the pedicle was a distinct line of demarcation and it was thought that there was sufficient viable skin to effect closure if the tumour could be removed. As the child's general condition still seemed good, and as it was obvious that such a huge appendage with inevitable gangrene and sepsis was incompatible with life, it was decided to attempt the removal of the tumour.

Prior to operation an x-ray was taken of the baby to ascertain if the findings of palpation with regard to the absence of skeletal connection between the baby and the parasitic fetus could be substantiated. This x-ray is shown in Fig. 2. A cut-down intravenous injection of normal saline through a gold needle was begun in one saphenous vein and the infant was anæsthetized with open ether. An incision was made through the skin about the pedicle of the tumour just to the viable side of the demarcation line of blueing. The tumour was then carefully dissected off the living infant's tissues. The separation was not difficult. In the dissection the gluteus maximus, sciatic nerve, and ischial tuberosity were exposed in turn on each side. The parasite seemed to be fairly closely adherent to the baby's rectum throughout most of the extent of the latter, but the separation was effected, without opening the rectum, back to the tip of the coccyx. Just in front of the tip of the coccyx quite a large artery, apparently a continuation of the middle sacral, entered the tumour. This vascular pedicle was divided between clamps and tied. The tumour was adherent to the back of the sacrum and coccyx but appeared to have no connection with the spinal canal.

When the tumour had been completely removed and hæmostasis secured it was apparent that closure of the wound would have to be carried out in a transverse manner in order to push the rectum up into the hollow of the sacrum and approximate the anus closer to the coccyx in the normal relationship. As it lay exposed the rectum extended forward from the sacrum to the anus a good three inches away from the coccyx. Interrupted plain catgut

sutures were inserted in the subcutaneous and fascial tissues of the upper and lower margins of the wound, but these were not tied until a gram of sulfathiazole powder was sprinkled into the large raw area. This precaution was thought to be necessary in view of the possibly contaminated state of the degenerating tumour. When these deep sutures had been tied it was found that the infant's coccyx had to be removed in order to get approximation of the skin margins without tension. After this had been done another one-half gram of sulfathiazole was sprinkled in the wound and the skin was closed with interrupted silk sutures. Seventy-five c.c. of compatible whole blood were given intravenously during the operation.

Following the operation the baby weighed four pounds, four ounces, and his condition seemed satisfactory. The wound received no special care except to wipe it off with alcohol and dust it with sulfathiazole powder each time the baby's diaper was changed. It was kept covered with sterile gauze and healed by first intention. The sutures were removed in eight days. The baby's general condition was excellent. A photograph of the incision taken three weeks after operation at the time of the child's discharge from the hospital is shown in Fig. 3.

The tumour was hardened in formalin for a week and then sectioned. A photograph of the most interesting cross section is shown in Fig. 4. It consisted largely of brain tissue and in the photograph the well developed convolutions of an almost perfect hemicerebrum can be seen. The pocket from which this half brain was raised for photographic purposes was lined by dura mater and further sections showed

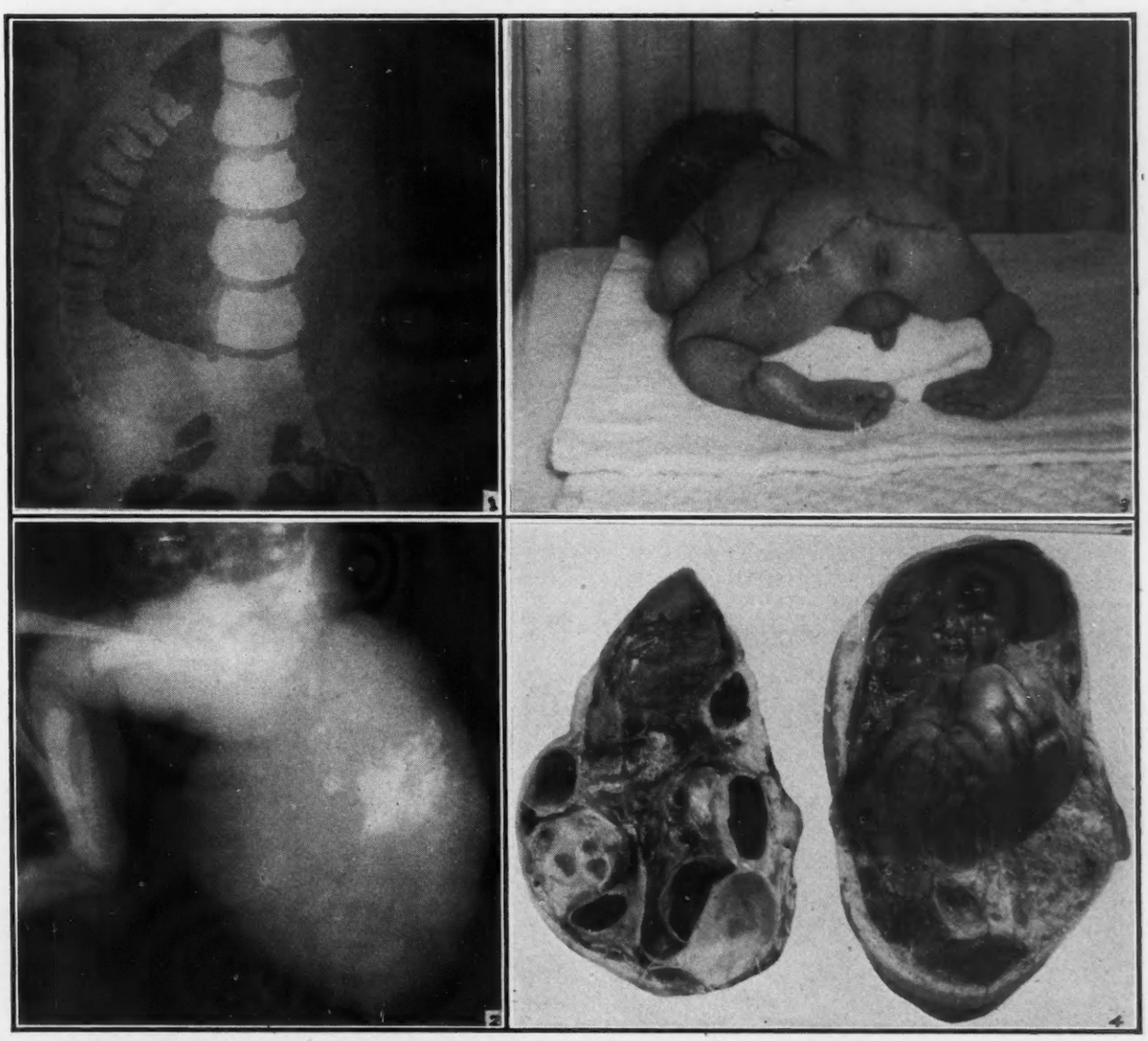


Fig. 1.—Prenatal x-ray showing bony tissue beneath the mother's left rib margin. **Fig. 2.**—X-ray of baby before operation. **Fig. 3.**—Incision three weeks after operation. **Fig. 4.**—Showing hemicerebrum in section of tumour, openings of hollow structures, bone tissue and lung tissue.

a ventricle and choroid plexus within the hemisphere. The small pale area with shallow lumina at the left in Fig. 4 proved to be bronchi and lung tissue. Some of the lumina contained cartilaginous rings in their walls and all were lined by ciliated epithelium underlain by submucous glands. The large openings of other tubular structures are readily seen. Some of these had walls which on section appeared to be vascular structures. Others were lined with high columnar epithelium tending to form papillary infoldings simulating gastrointestinal tract. The skeletal development does not show well in the photograph, but the pale tissue below and to the right of the raised half brain was bone. The microscopic sections of decalcified blocks revealed trabeculated bone with marrow and cartilage. Other microscopic sections showed cerebral cortex and subcortical white matter together with choroid plexus structure and dura mater, fat, voluntary and involuntary muscle fibres, lung, kidney tubules, typical lymph nodes, vascular structures and one ganglion composed of typical ganglion cells and neurones surrounded by a fibrous tissue capsule in well differentiated form. The skin covering the tumour was typical epidermis including coil glands, hair shafts, and sebaceous glands. It is possibly of interest to add that the maternal grandmother of the baby was a twin and had sisters who also were twins. Also the paternal grandmother had twins for cousins on both sides of her family.

DISCUSSION

The tridermal teratomata arise from totipotential cells and contain derivatives of all three germ layers. They represent the transition between simple tumours and monsters, depending upon the degree of differentiation of their cell structure. There are two chief theories as to their mode of origin. One is that they arise from the abnormal isolation of totipotential cells from the ovum at an early stage in gastrulation. Such dislocated blastomeres may turn up in any portion of the body and give rise to teratomata of the brain, neck, mediastinum, aorta, etc., examples of which have been reported in the literature. Such tumours, though showing cells of all three layers, tend to be simple and embryonic in structure and usually show no well differentiated organs. They represent one extreme of the range between simple tumours and monsters. The other chief theory of origin of these tumours is that they arise as parasitic twins. Siamese twins are the monsters which substantiate this theory most convincingly, and of course, represent the opposite extreme in the range of differentiation. It is possible that both theories are correct in essence and that the final structure and location of the tumour, whether simple and embryonic, or well differentiated into adult organs as in the case presented, depend upon how early in the process of gastrulation the totipotential cell or cells giving rise to the tumour become separated off from the primary fetus. The malignant teratomata arising usually in the ovary or testis of adults may have a similar origin. If so, the totipotential cells in these cases have lain dormant in the tissues until a late date. No adequate explanation of why such tumours arise in the gonads has as yet been forthcoming. But the fact that they do appear in the gonads almost exclusively suggests that they may take origin in germ cells which have undergone a kind of parthenogenetic development, apparently being stimulated without the occurrence of fertilization and fusion with a germ cell of the opposite sex.

Sacrococcygeal teratomata have been reported on many occasions and estimates of their incidence vary in the literature between one in 20,000 and one in 35,000 births. A report of a case diagnosed *ante partum* has not been found, although several standard textbooks of obstetrics mention it as a cause of obstructed labour. Usually the delivery is so difficult that the child is stillborn. The few surviving delivery rarely live more than a short time.

This case is presented as of interest in so far as a sacral parasitic fetus has been successfully removed from an apparently normal child. The tumour was almost half the weight of the separated infant and was made up largely of brain tissue. But structures of many organs and tissues of the adult body were also found. It was attached to the child by a wide pedicle but fortunately did not communicate with either the spinal canal or gastrointestinal tract of the infant. Primary closure of the wound was achieved.

The baby undoubtedly owes his life to two main factors: (1) The fact that labour was induced at seven months because of the mother's toxæmia. (2) The lack of communication between the tumour and any vital structure of the infant.

HEALTH INSURANCE AND MEDICAL EDUCATION*

BY WILDER PENFIELD, M.D., D.Sc., F.R.S.C.

Montreal

THOSE who would plan for the future must assume that the victory will be theirs. Without it, plans will be made for them, not by them. When the nations of Europe and Asia are at last freed to struggle back to their feet, Canada will face crucial economic problems. But this country will also face urgent internal problems concerned with the betterment of national health and medical science. Those who work to win this war have a right to hope that in so doing they may inherit a post-war world worth winning.

Medical economics usually interest practising physicians and surgeons but little.† But health insurance and even state medicine are now in force in a variety of forms and with varying success in European nations. Consequently the question of what Canada should do in this field during the post-war period presents itself for careful consideration even by those who, like myself, cannot pose as experts in medical economics. It seems logical at the outset to assume that, should the Government undertake to socialize medical practice after the war, it must also admit responsibility for the support of medical research and must interest itself to some extent in medical education. The nature of the problem of socialization and the need for medical advance will be discussed briefly.

THE EVOLUTION OF SCIENTIFIC MEDICINE

Scientific medicine is a recent phenomenon. With a few exceptions, such as the discovery of the circulation of the blood by William Harvey, no important advances were made until after the middle of the 19th century. Since that time, in a brief 100 years, a body of learning has come into existence which, at least according to current undergraduate opinion, no one student can now master.

There have been many successive reversals in the principles of practice. For example: at the beginning of the above period the efficacy of blood letting was first questioned on statistical grounds. Previous to that time it had been considered a sovereign remedy for practically every ill to which man was heir, and the number of those ills was legion. Contrast this point of view with our present attitude towards transfusion. We now seek to bleed healthy men and women by the thousands in order to secure enough blood to inject into the veins of the shocked and the wounded. Indeed, we have learned to preserve it, to divide it into its constituent elements, to freeze it, and dry it, so that no distant medical unit, whether at sea or in the desert, will be without some form of blood transfusion agent.

One hundred years ago fashionable physicians carried about with them gold headed canes and an air of omniscience, which must have served the important purposes of faith healing very well indeed, but which left the syphilitic to run the distressing course of his disease, the infected wound to wallow in so-called "laudable pus" until, with the blessing of Heaven, it healed despite surgical interference. Some physicians even carried muffs to preserve their sense of touch, their *tactus eruditus*, so that they might the better palpate what they could not understand.

Today, by means of the x-ray, we are able to see almost all the organs, at least in outline. We may inject contrast liquids and gases and watch them, by means of this ray, trickle and bubble through practically every vessel and duct in the body. This is not the place to chronicle the laborious steps of medical advance. It is enough to point out that many medical riddles have been solved, but many more call for solution.

Leadership in the arts and sciences generally has come periodically to different peoples at different times. The Chaldeans, the Egyptians, the Greeks bore the torch in turn. The Romans

* From the Department of Neurology and Neurosurgery, McGill University, and the Montreal Neurological Institute.

Address before the Joint Session on Post-War Reconstruction in Canada, Royal Society of Canada, Toronto, May 29, 1942.

† In spite of this fact, the Canadian Medical Association, perceiving the shadows casts by "coming events", published a series of recent studies on this subject, and the Royal College of Physicians and Surgeons is proceeding with the task of the certification of specialists, a step that should precede any large scale organization of medical service.

ruled, and then the light seems to have gone out. After the sleep of the Middle Ages, intellectual awakening occurred first in the rich merchant cities of Italy, and it was then that universities came into existence. Since then, and to an ever increasing extent, the world's universities have been the centres of learning, laboratories of intellectual advancement, whose contributions have been made available to all the world.

Scientific Medicine Today

Medicine has gone a certain distance along the path of discovery. If it had not, its socialization would hardly be worth while. Much remains to be done, and during this war research in pure science is fading out like a light that flickers and dies beneath the smoke of battle around the world. Many scientists have become combatants; others are locked up; some are dead; and still others have given their talents to solve the problems of mass slaughter. When we consider the road back to peace, it will obviously be Canada's turn, or at least her opportunity, to assume academic leadership. To that end the universities must turn to the Government for help as the Government should turn to the professions for guidance.

Socialization of Medicine in Other Countries

To explain health insurance, Hugh Wolfenden* has pointed out that the essence of insurance is the payment of contributions by, or on behalf of, a reasonably homogeneous group into a common fund and the distribution of benefits to those members, and to no others, on certain definite conditions. The benefits may be distributed to the patient in money with which he may buy medical services, or in kind in the form of free medical service.

The first national scheme of health insurance was launched in *Germany* in 1883 under Bismarck. It was initiated as the result of political considerations. They drew upon the lessons of the old guild funds. They began with cash benefits and ended with benefits in kind. They began with little consideration for co-operation on the part of the medical profession, and there resulted a great deal of dissatisfaction and bitter altercation.

In *Great Britain* compulsory health insurance was introduced by Lloyd George in 1911, and it must be admitted that this scheme also had a primary political aspect. It incorporated all the numerous "Friendly Societies", of which 80% were in a state of insolvency. But at the beginning the doctors themselves were almost completely ignored. Consequently, mindful of the controversy in Germany, they refused to co-operate. The eventual result, characteristically enough, was a compromise, which finally began to operate with relatively little criticism, and in 1937 there were 19,000 practitioners (over half of the total number) enrolled in panel practice in Great Britain.

At the present time the panel system may be described somewhat as follows. Those doctors and pharmacists who are willing to furnish such service place their names upon a panel. Individuals who are included in the insurance scheme may present their cards to any such doctor, who keeps them on his list. Until the card is withdrawn, he must provide free medical care to them as often as they wish to consult him, and sometimes that is often indeed.

The panel physician is remunerated by a capitation fee of nine shillings annually for each patient on his list. No physician may receive more than 2,500 cards. He may, however, add 1,500 cards to his list for each assistant whom he employs. Panel physicians are allowed to carry on a private practice as well, and this has developed into a "front door practice" for private patients and a "side door" practice for panel patients.

The panel scheme is not an unqualified success, but it has virtues and it has at least been demonstrated in Great Britain that compulsory health insurance can be placed on a sound financial basis, provided there is exercised adequate medical and actuarial control.

In criticism of national health insurance as practised so far, it should be pointed out that there are certain obvious defects. No hospitalization is provided; there is no provision for securing the services of specialists, and, more important than all the rest, is the failure to include the dependents of the insured persons or to include the independent workers who are not employed. Furthermore, the system will not work in remote and sparsely settled areas. A different scheme must be used there, such as the "Highlands and Islands Medical Service" in Scotland, which is a form of state medicine.

* The Canadian Medical Association and the Problems of Medical Economics, by H. H. Wolfenden, Toronto, 1941. This monograph, which appeared in instalments in this *Journal*, provides an excellent analysis from the point of view of an actuary.

State medicine is a scheme under which the Government accepts full responsibility for and direction of medical services. T. C. Routley has provided the following definition, "By state medicine is meant a system of medical administration by which the state provides medical services for the entire population or a large part thereof, and under which all practitioners are employed, directed and paid by the state on a salary basis."

In *Russia* state medicine has been introduced on a thorough-going basis. Medical service is free. Soviet physicians are divided into three large groups: practitioners, public health physicians, and specialists in the care of mothers and children. The central feature of Soviet medicine[1] "is the concentration of medical practice in dispensaries, polyclinics and hospitals". Emphasis is laid on the problems of maternity and infant care, factory hygiene and control of venereal disease.

Curiously enough, candidates for the study of medicine are selected by committees of workers and preference is given to selection of manual workers. The student is paid a salary from the beginning. The full course is five years, but preliminary preparation is deficient and the demand for physicians is so great that even one year of internship is often omitted.

According to Sigerist,[2] scientific research in Russia is considered "the most powerful instrument that the State possesses for the fulfilment of its task" and more money is said to be appropriated for research than in any other country. The Academy of Science, originally founded by Peter I, had come to have an annual budget in 1937 of 117 million roubles. Under it there were 49 research institutes devoted to natural science, sociology, and technology. The Maxim Gorky Institute for experimental medicine includes a staff of about 600 scientists. A branch of this institute was directed by the late Ivan Pavlov, one of the world's greatest physiologists.

It seems evident that with such an organization, and if such support is maintained in the peace to come, Russia might well stage a scientific development similar to that which was produced in the United States between 1900 and the present time by the unprecedented grants from the great Foundations and from private bequests. At all events, the evidence indicates that the level of general medical care has improved enormously under state medicine, as compared with the earlier system in Russia.

Socialization of Medicine in Canada

Our way of life is obviously different and the organization of medical care here is built up on an entirely different basis. Adoption of state medicine organized after the pattern of the Russian system would be just as preposterous in this country as to assume that the history, geography and social problems of the two countries are identical.

Legitimate government concern for the health of this nation should be directed toward two kinds of medical practice.

First, there is *preventive medicine,* or public health work. In this field is included sanitation, vaccination, segregation of communicable disease, hygiene for schools, factories and homes. This includes prevention of venereal disease, prevention and cure of tuberculosis, care of the incurable and insane, and supervision of the diet of the nation. This is the proper field for state medicine. The doctor's services should be hired as well as nursing, pharmaceutical and dental care, and health rules should be enforced by law.

Secondly, there is *curative medicine.* In this field little has been accomplished in this country, although a beginning has been made in certain western provinces. Curative medicine presents a problem which must be individualized, for the man who is sick is an individual. He needs personal attention from doctor and nurse. Without a personal relationship the art of the practice of medicine no longer exists and the science of medicine becomes cold, uninteresting, and less effective.

When government agencies enter the field of curative medicine they should accept one guiding principle: to improve the medical care of those in need of it without lessening service to those elements of our population already relatively well cared for. In other words, innovations must not "upset the apple carts" which are already on the highroad to reasonable success.

At the present time, in well populated districts, the comparatively rich receive care at home and in hospital equal to that in any part of the world. This we may call "adequate". The pauper often receives adequate care while in hospital and good care in hospital out-patient clinics. At home, however, he often receives

relatively inadequate care. The middle class worker receives relatively satisfactory service from medical practitioners at home, and those workers in the upper income brackets receive excellent service in public hospital wards for which they pay a fraction of the cost.

On the other hand, there are two classes in Canada to which attention should be directed. First there is a large intermediary group, in which living standards are high but incomes are low, which badly needs some form of health insurance. Families in this group can afford care from their family physician, but they are not considered eligible for government support and they cannot afford the high cost of hospital care and consultation. Teachers in school and university, and members of clerical and professional classes may find themselves in this group. It would seem wise to utilize the methods of *health insurance* to assist these middle class citizens so that they may be protected against the financial burden of serious illness. This may be done in several ways: (1) by a plan of prepayment for hospital care, (2) by provision of cash indemnity in case of proved illness, or (3) by some form of panel practice.

The second group is to be found in rural districts where the situation may also be unsatisfactory although the problem is quite different. The supply of physicians is often inadequate, and medical service, both at home and in hospital, is sometimes unobtainable. Some form of state medicine may be necessary to relieve suffering in impoverished or in sparsely settled districts of the country. In some way practitioners must be placed in these areas while still providing for professional contacts with medical centres.

It is easier to indicate where the "shoe pinches" than it is to prescribe a specific remedy. Wherever indigents are to be found the burden should be placed upon the state rather than upon private charity. But caution must be observed if the process of socialization is to be extended. Completely free medical service and free diagnosis certainly result in unnecessary procedures and thus produce increased total cost of medical care. When visits to a physician are quite free and easy they are made too often and the quality and value of medical advice inevitably declines.

When the personal relationship of doctor and patient is lost, both patient and doctor are the losers. If unwise regimentation of physicians is attempted those independent characteristics which made men good doctors will lead them to revolt. The average medical student of today looks forward to becoming a general practitioner of medicine. If he were told that at the end of his long training, he must enrol as a kind of civil servant, he would probably stop his toil in medical harness and cast his eyes toward freer, greener pastures.

To be successful in Canada any degree of socialization of medicine must secure the approval and co-operation of our independent-minded body of physicians. We must do for the Canadian public what the schemes of health insurance already mentioned in other countries have failed to do: *i.e.*, provide for hospital treatment and for consultation and treatment by specialists; also provide for the care of dependents of those insured. Above all, we must make the general practitioner of medicine the keystone of the structure and leave a degree of freedom of choice in regard to medical care to the individual patient.

A corollary to any form of socialization of medicine should be assistance from the Federal Government to the universities of Canada and the university hospitals. Improve the kind of medicine practised. Extend the organization of the university hospitals until there is a relationship between them and the country practitioners, so that these outlying members of the profession may have a mechanism for hospitalizing their patients, so that they may secure consultation when necessary, and may themselves return to the hospital for periodic advice and instruction, and may themselves hope to advance to the post of consultant by dint of continuing study and successful practice. If this is done it will no longer be difficult to tempt physicians into rural districts.

Such proposals are being made at the present time in Great Britain. Due to present displacement of the medical profession there and the alteration in the way of life, physicians are willing to contemplate a new order of some sort. John Ryle,[3] Regius Professor of Medicine at Cambridge, suggests a series of 5-year plans to win over the medical profession to a scheme which would place some of them on a whole-time salaried basis and others on a half-time basis; which would create medical centres and community clinics that would be co-ordinated with municipal hospitals and teaching hospitals.

The former would receive municipal support, the latter government support through the universities.

It is possible, of course, with the aid of pen, paper and the armchair, to visualize an ideal medical organization, promoted by enlightened politicians and with complete enrolment of doctors who work without thought of fee in the flood of enlightenment that streams from the open doors of regional medical schools. This may seem a utopian conception but actually it is necessary to work toward something like that. Professor Ryle suggests that, with the final disappearance of domestic servants, the doctor's wife, spurred on by the curse of telephone and door-bell, will urge her hesitant husband into trial of some such scheme rather than to trek back to a deserted Harley Street to reopen his consulting room there after the war is over.

It is the duty of a democratic government to make reasonable provision for the health of its citizens, but this cannot be done alone by co-ordination of medical services. It is also a duty to promote scientific advance.

FEDERAL ASSISTANCE TO INTELLECTUAL ADVANCE IN OTHER COUNTRIES

In the United States and Canada funds for research have been derived largely from private fortunes in the past. The present system of taxation may well dry up such sources. In other countries the governments have played a more important rôle. Patronage of science in Russia today was described above. Germany and Great Britain have in the past done this in a very different manner.

In the latter part of the 19th century came the ascendency of German science and letters. The ministry of education in each German state took on the active support of the universities of that state, and included in this support art, theatre and opera. As a result of this financial impetus and a well conceived plan of co-ordination there occurred, in the seventy-five years before the Great War, unequalled physical expansion of their universities. It was then that Germany's intellectual heroes appeared.

This time has passed. Universities have interested the National Socialist Party in Germany very little. In "Mein Kampf" Hitler refers to the universities of this period of Germany's development with contempt, saying that the result of their system "was not the strong man but rather the pliable possessor of much knowledge. Our higher school education", he states, "produced not men, but rather officials, engineers, chemists, jurists, litterateurs, and in order to keep this intellectuality alive, professors." The leader of Germany today would expect of education only that it should instil into his followers: "trustworthiness, readiness for self-sacrifice, silence".

Following the last war the government of Great Britain undertook to stimulate higher education and research by creation of a University Grants Committee. Through this committee grants for specific purposes were made to educational institutions which were selected without political consideration as most likely to do good work. In 1936 the committee made a report which is well worth study.[4] It recommended that to 19 institutions, selected from a possible 59, an annual grant should be made of £2,250,000. This involved an increase of £270,000 over the annual grants of previous years.

After making the above recommendation this government committee made the following important observation. "We believe that the British universities may be trusted to make the best use of any new resources which may be made available." They added that, for the sake of independence, the main financial support should be from other sources than that of the state, for—to quote again: "Freedom is to a university the only atmosphere, the 'ampler ether', in which it can breathe and maintain its vitality".

SCHOLARSHIPS AND A UNIVERSITY GRANTS COMMITTEE FOR CANADA

A cure for tuberculosis would be better, and might conceivably cost less to discover, than many more millions for sanitaria and asylums. Cure for cancer and insanity is better than care for human wrecks. Such cures may well be provided in the years that lie ahead.

The Federal government can stimulate research and assist higher education without taking over from the provinces the responsibility of the support of education. The Canadian government made a beginning by creating the National Research Council during the last war and has sponsored through it research of great importance both to her wartime and peacetime purposes. But aside from military projects no help has been granted to research in her universities.

For generations young Canadians have gone, hat in hand, to the universities of Europe for their graduate training. The pioneering days are past. The time has come for us to pay our way and to support those institutions of higher learning here to which the students of the world will want to come.

There is another way in which help to research undertakings will be of benefit. It will automatically improve the level of university instruction, for it is only the teaching of men who are themselves students, or investigators, or both, that is capable of inspiring leadership. Mr. J. A. Scott[5] has put this into better phrase: "He who learns from one occupied in learning, drinks of a running stream. He who learns from one who has learned all he has to teach, drinks 'the green mantle of the stagnant pool'."

The National Research Council has granted a few minor scholarships in Canada. Young Canadians have often won and profited by travelling fellowships, but the funds have been derived from Britain and from the United States. The Scottish university students have used to good advantage about $235,000 annually in special scholarships* in addition to ordinary scholarships. We do not need less for a population over twice as great.

When peace returns the Canadian government might well consider contribution to Canadian universities in two ways: first, the establishment of a system of *scholarships* to Canadian universities; second, selective grants for advanced research in universities and university hospitals. For this latter purpose the establishment of a *University Grants Committee* would free the project from possible political implications.

Finally, in planning the future of medicine two major aims should be recognized: first, to improve medical service to the people of Canada, introducing certain aspects of state medicine and certain aspects of health insurance, but at the same time preserving those present institutions in our medical organization which are good; secondly, to promote scientific advance and scholarship in this field.

* Derived from the Carnegie Corporation of New York.

REFERENCES

1. NEWSHOLME, A. AND KINGSBURY, J. A.: Red Medicine: Socialized Health in Soviet Russia, Doubleday, Doran, New York, 1933.
2. SIGERIST, H.: Socialized Medicine in the Soviet Union, Norton, New York, 1937.
3. RYLE, J.: A whole time state medical service, *Brit. M. J.*, Feb. 21, 1942; Supplement, p. 33.
4. University Grants Committee, Report 1929-30 to 1934-35, London, His Majesty's Stationery Office, 1936.
5. Inaugural Lecture as first Principal of Owens College, Manches.er; quoted in (4).

RÉSUMÉ

La socialisation de la médecine par le gouvernement crée pour celui-ci la responsabilité de promouvoir la recherche scientifique et d'accélérer les progrès de la médecine. L'évolution de la médecine scientifique a été longue et difficile. Il reste encore beaucoup à découvrir et les découvertes se feront dans les universités. Tandis que la socialisation de la médecine a donné des résultats assez imprécis en Allemagne et en Angleterre, la médecine d'état paraît vouée à un succès certain en Russie soviétique grâce aux sommes énormes consenties par l'état pour la recherche scientifique. Au Canada la médecine préventive est bien comprise; quant à la médecine curative, il faudra l'organiser avec la coopération des médecins et obtenir pour les malades ce qui a manqué dans les autres pays, c'est-à-dire, le traitement à l'hôpital et la facilité de consulter des spécialistes; il faudra aussi que l'état aide davantage les universités. Le gouvernement Canadien peut améliorer la situation de deux manières: d'abord, en payant la scolarité de certains élèves dans les universités Canadiennes, et ensuite, en accordant dans des cas choisis des bourses d'études pour la recherche spécialisée à l'université ou à l'hôpital universitaire. Le but ultime de l'état doit être l'amélioration des soins médicaux, corollaire de l'élan donné à l'avancement scientifique.

JEAN SAUCIER

When pointing out that in blind persons, numbers of whom appear so far to have asked in vain to be taken into the national war effort, there is a small but important reservoir of man-power, largely untouched, the National Institute for the Blind, the National Association of Blind Workers, the Association for Promoting the General Welfare of the Blind, and the National Association of Workshops for the Blind have, in a joint statement, pointed out that blindness is a disability and not a cause of inability, that under pre-war conditions some 10,000 blind persons were earning their own living in manual, technical, and professional occupations, and that there are hundreds of jobs in ordinary industry which can be undertaken by intelligent blind people, particularly those trained from their earliest years to disregard and overcome their handicap. On the sound principle of learning from the enemy the associations mention that the Germans after the last war legislated for the employment of a given percentage of disabled men in factories. A large number of blind men, war blinded and others, came within this scheme and successfully proved their capacity to operate many types of power-driven machines. It would appear that the chief obstacle to the wider use of blind persons in industry is the reluctance of some employers to believe that they can be skilful as well as hard-working.—*J. Roy. Inst. of Pub. Health & Hygiene*, 1942, **5**: 87.

THE MODERN CONCEPTION AND TREATMENT OF FROST-BITE

(A SURVEY AND DISCUSSION OF THE LITERATURE)

BY CAPT. W. G. BIGELOW, R.C.A.M.C.

THE treatment of frost-bite may become a major surgical problem facing the Royal Canadian Army Medical Corps in the next few years. One has only to look at the reports of high morbidity rates and death due to frost-bite in the Russo-Finnish, Italian-Greek, and Russo-German campaigns to realize the importance of the problem. Moreover, as is well known, frost-bite most commonly attacks the extremities. The loss of these and future disability from painful joints and sensitivity to cold are problems of importance.

It is a striking fact that very little Canadian literature exists on this subject, and opinion varies as to treatment. First Aid manuals are contradictory, and, in some cases, they impart harmful advice. The present war has been a great stimulus to the study of frost-bite in Europe, but it is with difficulty that recent foreign publications are procured. Our usual form of treatment which consists of rest in bed, with sterile or antiseptic dressings to prevent infection, together with a prolonged period of observation, during which we watch the gradual formation of a line of demarkation with gangrene, leaves much to be desired.

FROST-BITE AND TRENCH FOOT

The difference between true frost-bite and so-called "trench foot" should be clarified before proceeding. Although they probably possess a closely related pathogenesis, their predisposing conditions and clinical pictures are distinctly different.

TRENCH FOOT

This condition, called also immersion foot or water-bite, was seen, particularly in the early years of the last war, in men confined to wet trenches, whose feet were exposed to cold water over a period of time. Records show that the temperature of the water had not necessarily to be below the freezing point to produce trench foot. Temperatures up to 45 and 50° F., particularly when associated with inactivity and constricting clothing about the feet and legs, were sufficient cause.

Trench foot is a relatively slow process, developing usually over a period of days. The feet become numb and anæsthetic. Later, pain develops on the extremes of movement, associated with marked swelling, usually making it necessary to cut off the boots. The feet appear sodden, cold, clammy, and in severe cases blisters develop, often with deep fissures through the skin. Some reports from the last war tell of very gratifying results in most cases with conservative treatment, although moist gangrene was the sequel to too long exposure. The distinguishing features are, thus, severe pain and marked swelling.

The effect of wet is strikingly explained by Lewis,[18] and Green[12] on the theory of "supercooling". Dry skin surface can be reduced to −20° C. without the occurrence of freezing, while the whole thickness of skin may be reduced to −10° C. and still remain unfrozen. Skin soaked in water, however, does not supercool, thus the phenomenon of trench foot will occur at a much higher temperature. Skin soaked in oil or allowed to go unwashed, on the other hand, does supercool to some extent, thus discouraging freezing.

Little or no trench foot has been seen in the present war. This is no doubt due to the relative absence of trench warfare and the mobility of troops. Amongst 500 cases of frost-bite treated during one offensive in the Spanish Civil War, Ducuing reports the complete absence of trench foot. The condition is being found, however, in persons left adrift for several days in the North Atlantic on rafts or in life-boats, and has become a problem in treatment for the Naval hospitals.

FROST-BITE

This condition is well known to most Canadians. It is a relatively rapid process. The skin becomes blanched and, subjectively, a tingling or stinging sensation is followed by a sense of numbness. Ducuing[9] reports that the first complaint of soldiers was numbness and difficulty in walking, but no real pain. The extremity is white and firm, with slight swelling and anæsthesia. The apparent œdema does not pit readily with pressure, and movements of the extremity are slight or impossible.

The process of thawing or recovery of the frozen part, although varying with the intensity of exposure, goes through the stages of redness or apparent hyperæmia, then swelling accompanied by the formation of blisters. In severe frost-bite, or in cases where unnecessary trauma or too rapid thawing has occurred, these blisters may be very large and filled with a straw-coloured or sometimes blood-tinged fluid. This process is often accompanied by pain varying from a dull numb aching to severe pain requiring sedation.

Some cases proceed to recovery from this point. In the majority, however, the skin over the greater part of the involved area, and particularly the toes and pressure points, such as the heel and ball of the foot becomes black, firm and dry. This produces the effect of complete gangrene involving the entire blackened area. Leriche,[16] however, points out that at this stage it is impossible to determine how much living tissue is going to show up underneath. Later on, he states, the black skin peels off and may reveal healthy, fresh granulation tissue, with newly formed skin, or a dry gangrene extending down to and adherent to the bone. Ducuing refers to these as (*a*) superficial and (*b*) deep gangrene.

The end-results may be summarized as (1) complete recovery; (2) recovery with residual neuralgic pains, joint pains, hypoæsthesia or sensitivity to cold, of which some cases, years later, show intermittent claudication as in peripheral arteriosclerosis; (3) gangrene is usually dry and most often involves the fingers and toes or such pressure points as the heel and ball of the foot. The final line of demarkation is slow in forming and it is the general opinion that amputation should be late.

Because this temporarily devitalized tissue is susceptible to infection, precautions should be taken against tetanus. Infection of the blisters or at the line of demarkation is to be avoided in order to prevent a moist gangrene which, fortunately, is rare.

Predisposing conditions are severe cold, wind, altitude and constricting clothing. Lewis[18] discusses the freezing point of skin and observes that it must take place between –2 and 0° C. Brahdy[3] speaks of frost-bite as frequent with a temperature of –13° C. and demonstrates from a series of 388 cases the importance of wind as a causative factor. Green,[12] with experience in the Himalayan and Everest expeditions, speaks of instantaneous frost-bite "on touching the button of a camera with the finger at high altitude". He discusses the danger of low oxygen tension, well known to fliers, and besides advising the use of oxygen for prevention and treatment, describes a definite "warming effect" following its use. Ducuing[9] mentions frost-bite of the hands in three airmen following one hour's high altitude flying. In the opinion of Theis,[26] vascular disease of the extremities which reduces the blood flow to the part, renders the individual more subject to the effects of cold.

Physiology: (1) *"H" substance.*—Frost-bite in its early stages produces a physiological reaction in the tissues similar to that resulting from exposure to heat or ultra-violet light. The insult to the tissues caused by any one of these three produces a general reaction to tissue injury based on the liberation of a tissue "H" substance. Of course excessive heat has the power to coagulate tissue, but the early phases of each are similar. Lewis,[18] in a comprehensive study of skin reactions, describes the effect of short periods of exposure to cold in producing the "triple response" characterized by local redness, wheal, flare and blister.

His well known theory assumes a liberated tissue substance acting on the vessel directly to produce dilatation and increased permeability followed by axonal reflexes extending this process to cause, finally, œdema and blister formation. The obstruction to circulation produced by the œdema and the increased tissue metabolism stimulated by the tissue reaction to injury, produce an oxygen deficit in some cases, which explains the cyanosis or blue colour sometimes observed.

2. *Stasis.*—The further reactions in the tissues as freezing progresses, are thought by several writers (Brahdy and Kahn,[2] Green,[12] Lewis[19]) to be those of blood vessel damage by ice particles with vascular thrombosis and necrosis. The European school, however, led by Tannenburg, Ricker and Kreyburg, have added to the physiological conception of frost-bite. They have carried out minute and detailed study to show experimentally that, following the initial reaction to the liberated "tissue substance", the phenomenon of "stasis" occurs.

They contend that, although a moderate reaction to tissue injury will produce a dilatation

of minute vessels with exudation of serum, a severe injury will cause an exudation of all the fluid elements of the blood, leaving the vessel completely blocked by a column of red blood cells. Should this reaction not be reversed, it follows that necrosis will occur in the area previously supplied by this vessel. By increasing the intensity of a noxious stimulus to the tongue of a frog this phenomenon can be observed.

Kreyberg[15] devised an ingenious experiment to demonstrate "stasis" in frost-bite lesions.

> First injecting a rabbit with vital stain (lithium carmine) he freezes small areas of its ear, using a carbon dioxide snow pencil with increasing periods of exposure (1, 3, 5, 7, 12 seconds). Intracardial India ink injection is given 24 hours later. Area No. 1 shows dilated small vessels filled with India ink and evidence of transudation. In the remaining areas, the vessels are dilated but blocked with red blood cells and no India ink is present. He uses a control series with injection of ink 15 minutes after freezing. All areas appear as No. 1 in the first series.

Tannenburg[25] gives an exhaustive description of the phenomenon of "stasis". He states that "it is a colloidal chemical problem, as opposed to the purely mechanically limited blood clot. The cells in stasis agglutinate to a homogeneous red column, in which the individual erythrocytes are no longer detectable (microscopically *in vivo*), compared to blood clot, where this is not the case." He differentiates stasis from "coagulation" or "thrombosis" by showing that the former occurs in the capillaries and minute arterioles and is a reversible reaction where the erythrocytes can be liberated from the stasis column undamaged. He admits that it is a difficult diagnosis to make histologically.

As early as 1883 T. V. von Recklinghausen differentiated between stasis, blood clot and thrombosis. More recently, Ricker[22] has placed stasis as the most important of circulatory disturbances, a phenomenon which he feels is caused by a paralysis of the vasoconstrictor and vasodilator nerves of the small vessels and capillaries, producing a slowing of their stream. Tannenburg,[25] by a series of experiments, however, feels he has disproved this theory and reestablishes the cause as a transudation of fluid from the vessel wall and a chemical change in the blood itself. He proves his contention for a chemical change by a series of observations in which he compares the action of suspended red blood cells in normal blood and the blood of one affected by stasis.

Tannenburg states further, "Thoma, in his text-book of pathology was able to observe the disintegration of a stasis column, if the blood flow to the part is altered (increased) rapidly so that the products of tissue breakdown which have given rise to stasis can be washed away". Further experiments to prove this have been performed separately by Genzmer and Regenbogen, with confirmation of his findings. Merk,[20] in studying the experimental formation of stasis, makes observations on conditions required to reverse the process. He states that the two main factors in its production are a "high concentration of tissue degeneration products", and a diminished "current velocity of the blood". By inducing hyperæmia in the affected area, however, the "metabolic products producing stasis are diluted and transported away by a rapid flowing blood stream". In such cases, the stasis column disintegrates, and the local disturbances in circulation disappear.

3. *Thrombosis.*—Although it has been proved that thrombosis of small arteries is present in a frost-bitten extremity in the stage of gangrene no one has attempted to determine when or how long after exposure to cold this occurs. Leriche[17] made arteriographs in which he exposed the posterior tibial and brachial arteries and injected thorotrast into the frost-bitten extremity in cases of gangrene. His photographic reproductions of these show either complete obstruction or irregular nodules projecting into the lumen. Pathological examination of the vessels explained the presence of the nodules and verified the diagnosis of thrombosis made from these x-rays.

4. *Vasospasm and sympathetic hypertonia.*—The presence of a sympathetic hypertonia in a limb exposed to frost-bite is claimed by several writers. The most thorough investigation of this has been carried out by Ducuing *et al.*,[9] who tested the sympathetic tone of the exposed limb in a large number of soldiers. By means of a test, similar to our Landis test, which records the "Brown Index" (following induction of fever in the patient), they have demonstrated an apparent vasospasm and a hypertonia of the sympathetic nerves in the affected limb. They put these tests to use to indicate those cases which were suitable for treatment by lumbar sympathectomy or to determine whether or not the lumbar sympathetic anæsthesia had been effective.

Leriche[16] theorizes that there must be an associated vasoconstriction in the limb affected by frost-bite. Soupault and Orsoni[24] report a case of frost-bite of one hand which demonstrated a clear-cut Horner's syndrome on the affected side. All these investigators advocate treatment by sympathetic anæsthesia with novocain or extirpation of lumbar sympathetic ganglia.

Pathology. — Biopsies taken by Lewis[18] 24 hours after a superficial frost-bite show œdema of the dermis and epidermis "with perivascular infiltration of the superficial layers of the dermis by lymphocytes, red blood cells and polymorphonuclears." Ducuing *et al.*, took a series of biopsies as frost-bite gangrene progressed in a case requiring amputation, which showed the picture of gangrene from circulatory obstruction. The arterial changes were significant. There was, first a separating of the intima from the internal elastic lamina which produced an irregular infolding. Medial and adventitious lesions followed. Later, loss of substance of the intima produced a herniation of the media into the lumen. The entire area involving all layers finally became scarred. Arteries that showed obliteration by a thrombus showed no signs of acute inflammation. Leriche[16] describes a similar picture when he discusses alteration of the intima of the arteries with phlebitis and, at a later stage, phlebitis with obliteration of the lumen and arterial thrombosis. These findings ably explain the results of his arteriograph and indicate that the later gangrene may be vascular in origin.

Bone injury may follow in severe cases (Murphy[21]), "Osteoporosis may develop, with necrosis of bone and subsequent sinus formation; joint spaces are narrowed or obliterated in late cases."

TREATMENT

1. *Principles.* — Some conclusions regarding the general principles of treatment to be observed may be made, in view of the knowledge of the physiology and pathology. (1) Injury to the frozen part should be avoided. The practice of rubbing will tend to damage the skin and increase the tissue reaction to the injury. (2) Some means should be found to increase the blood flow to the affected part at an early stage before secondary reactions of thrombosis and arterial change set in. This may reverse the process of stasis and supply oxygen to meet the demands of a locally increased metabolism. Green[12] feels that the blood vessels are damaged and cannot carry an extra flow of blood. The European investigators, however, do not hold with this view. (3) A slow rate of thawing should be used in order to minimize the metabolic demands of the tissue. (4) The question of thrombosis suggests the possible use of heparin for its prevention and control. (5) Counteracting sympathetic spasm by means of sympathetic nerve anæsthesia or extirpation of sympathetic ganglia would also supply the required increase in blood flow. (6) Suitable precautions against infection should be observed.

2. *General methods.*—With few exceptions, investigators (Kreyberg,[15] Lewis,[18] Clouston,[7] etc.) advise against vigorous rubbing of the frozen extremity and advocate gentle handling. The main exception, Ducuing, states that in his series of cases all had received first-aid rubbing, before admission to hospital, which he felt was probably beneficial. Judging from the personal account of a North Greenland explorer, massage of the limb above the frozen area, using a firm downward stroke designed to force blood into the frozen extremity, would appear to be extremely beneficial. Three members of this party in 68° F. below zero weather suffered severe frost-bite of the feet and lower legs. This type of massage without touching the frozen area, carried out in a cold room was the only treatment received. Although their recovery was slow it was complete. If such a massage relieves arterial spasm and forces arterial blood into the extremity, then the rationale of such a first aid measure is good.

To ensure slow thawing, Kreyberg,[15] suggests keeping a small ward cooled to somewhere between room temperature and freezing for early cases. A more beneficial type of treatment may be local refrigeration of the extremity with heat to the remainder of the body. This would aid in counteracting shock and produce a reflex vasodilation in the affected limb. The latter can be obtained, as the Canadian Army pamphlet suggests, by immersing the *unaffected* limb or limbs in hot water. Refrigeration should be continued one to several days, depending on the severity of the lesion. Lewis suggests that controlled thawing may be accompanied by "the application of cold water at 10 to 15° C." Cooling relieves to some extent the pain which accompanies thawing.

Kreyberg advocates elevation of the extremities to aid venous return. He describes this treatment for both upper and lower extremities as used in the Russo-Finnish war. Sterile dressings should be kept on the limbs and pressure points carefully protected.

Prophylaxis is obvious on consideration of the predisposing factors.

SPECIAL FORMS OF TREATMENT

1. *Short wave therapy.*—In a symposium on frost-bite from the Italian French campaign, Uffreduzzi[27] and Cignalini[6] described the successful use of short-wave therapy. They feel that frost-bite is a necrosis due to anæmia, and that the process is reversible at times. Short wave administered in increasing doses (30 minutes' treatment and 30 to 40 treatments), helped to restore the circulation and promoted the final delimitation of the gangrene. The results of two series of cases, totalling 35, were quoted.

2. *Vasodilators.* — The use of vaso-dilator substances has never been discussed in the literature.

3. *Heparin.*—The use of heparin in frost-bite lesions has never been completely investigated.

4. *Arteriectomy.*—In severe cases, Ducuing reports having used arteriectomy to suppress an intense spasm of the peripheral arteries with what he considers satisfactory results.

5. *Vitamin therapy.*—Degos[8] describes how cutaneous lesions and neuritic pains which follow frost-bite rapidly improve after the administration of thiamine hydrochloride. Some authors advise high vitamin diets for soldiers as a protection against frost-bite.

6. *Refrigeration.*—The use of local refrigeration in the treatment of wounds and immersion foot is under investigation. Brooks and Duncan[4] have investigated the effects of temperature on the survival of anæmic tissues. His experiments show that temperature is an important factor in determining the length of survival of living tissues completely deprived of circulation. Gangrene, due to obstruction to circulation of a rat's tail, developed in 3 hours at 40° C. and 96 hours at 1° C. with intermediate gradations. In subsequent experiments, he reported the influence of temperatures on wounds and, he concludes, that "there is reasonable doubt as to the wisdom of inhibiting an inflammatory reaction by cold applications." All it accomplishes is to inhibit the inflammatory and post mortem changes in the necrotic tissue for the period of time in which it is exposed to cold. It would appear that refrigeration should not be considered a treatment for frost-bite. Rather, a temperature below body temperature should be maintained, primarily to minimize the oxygen requirements of the tissues in their process of thawing.

7. *Passive vascular exercise.*—In Hermann's monograph on this subject,[13] he deals with 23 cases of frost-bite to the extremities treated with the pavaex machine. He states that excellent results were obtained; the circulation was quickly re-established and even the most serious cases developed a relatively insignificant amount of necrosis. Prior to using pavaex, more or less extensive gangrene developed in every case. He summarizes: "Pavaex is a logical method of overcoming the stasis of the second stage of frozen extremities when actual obliteration by thrombosis, of the capillaries and venous pathways has not yet taken place. After this obliteration has taken place, gangrene is sure to develop."

Murphy[21] arrives at a similar conclusion after citing a small series of cases. He stresses the importance of overcoming the associated vasospasm within 24 hours. "This new method of conservative therapy offers rapid relief of pains and rapid restoration of circulation with complete recovery in cases treated early".

Shipley and Yaeger report two cases of frost-bitten hands treated with pavaex. They recovered with only the loss of fingernails, whereas several other cases given general lines of treatment as controls gave poor results.

Bugliari[5] very recently reports further success with pavaex in the cases from the Italian-French engagement. Most men familiar with pavaex, feel convinced of its usefulness, provided it is employed soon after exposure. Gardiner[11] feels it should be used within 48 hours. If frost-bite is essentially an ischæmia, then, theoretically, this form of treatment is indicated.

8. *Sympathetic anæsthesia and sympathectomy.*—A widely used method (in Europe) and one possessing probably the greatest possibilities, is anæsthetic block of the sympathetic nerves by novocain or, for severe cases, sympathectomy. In the upper limbs, stellate and peribrachial infiltration or peribrachial sympathectomy may be performed. Similarly, for lower limb lesions, lumbar or perifemoral infiltration may be replaced by lumbar or perifemoral sympathec-

tomy. All investigators using this line of treatment are very enthusiastic with their results. Ducuing, with the longest series of cases (a total of 500, with 102 serious cases), infiltrates the lumbar sympathetic ganglion in all cases, with excellent results. The cases, with a persistently raised "Brown Index" (indicating continuing sympathetic hypertonia in spite of previous infiltration), were dealt with by lumbar sympathectomy. The immediate results for both forms of treatment were cessation of pain and the appearance of red granulation tissue. In a bilateral lesion with ganglionectomy on one side only, the treated side progressed more favourably and rapidly. Of 102 serious cases, only 7 amputations were required (Symes and mid-tarsal). Twelve lumbar sympathectomies were performed.

Leriche[17] reports a series of 39 cases of frost-bite to hands and feet. On arrival, all cases with œdema and pain, had anæsthetic infiltration of lumbar or stellate ganglion. Practically all were immediately relieved and, with injection every three days, the blisters receded. None of the cases which were treated early ever developed gangrene, regardless of the severity of exposure. He used sympathectomy only in grave cases. He concludes that this is the only method of treatment and advises the Army to use it in all cases of frost-bite.

Leriche[16] in a further report, describes a case of advanced frost-bite of the hands. Stellar infiltration, then double peribrachial sympathectomy, stopped the progress of the lesion and the pain immediately. The œdema disappeared and loss of tissue from gangrene was minimal.

Simon and Filhoulaud[23] treated five soldiers seven days after exposure by repeated lumbar and perifemoral infiltrations with results very similar to the above.

Forster *et al.*, report a striking case of frost-bite to the hands where 9 days after exposure, the stellate ganglion was infiltrated. Immediately the movements of the hands were easier, œdema and pain disappeared and a persistent infection on the dorsum rapidly cleared.

All the above writers feel that even more striking results could be obtained if it were possible to treat all cases with infiltration immediately after the lesion is discovered. In the case of soldiers they advise this procedure at the Advanced Dressing Stations or even at the Regimental Aid Post. Further, with our limited knowledge of frost-bite, these cases could be congregated in certain base hospitals for investigation and treatment.

CONCLUSIONS

1. The treatment of frost-bite may become an important problem for the Army.

2. There is sufficient evidence in the literature to indicate that a moderate degree of freezing *per se* does little or no damage to the tissues, and with proper and early treatment dramatic results may be obtained.

3. In view of the evidence presented it would appear neglectful to treat frost-bite without recourse to specific therapy.

The author wishes to express his thanks to Dr. W. E. Gallie for his interest and advice in the preparation of this paper.

REFERENCES

1. BORINI, L. AND MATLI, G.: *Int. Abstracts*, 1941, **73**: 166.
2. BRAHDY, L. AND KAHN, S.: Trauma and Disease, Lea & Febiger, Philadelphia, 1st Ed., 1937, p. 90.
3. BRAHDY, L.: *J. Am. M. Ass.*, 1935, **104**: 529.
4. BROOKS, B. AND DUNCAN, G. W.: *Ann. Surg.*, 1940, **112**: 130 and 1941, **114**: 1069.
5. BUGLIARI, G.: *Int. Abstracts*, 1941, **73**: 166.
6. CIGNALINI, P.: *Int. Abstracts*, 1941, **73**: 166.
7. CLOUSTON, H. R.: *Canad. M. Ass. J.*, 1939, **40**: 166.
8. DEGOS, R.: *Bull. Soc. Franç. Dermat. et Syph.*, 1941, **48**: 124.
9. DUCUING, J. *et al.*: *Jour. de Chirg.*, 1940, **55**: 385.
10. FORSTER, E. *et al.*: *Mém. Acad. Chirg.*, 1940, **66**: 367.
11. GARDINER, W.: Personal communication.
12. GREEN, R.: *The Lancet*, 1940, **1**: 6077.
13. HERMANN, L. G.: Passive Vascular Exercises, Lippincott, Philadelphia and London, 1st Ed., 1936, p. 226.
14. KREYBERG, L. AND ROTNES, L.: *Acta Path. et Microbiol. Scand.*, 1932, **11**: 162.
15. KREYBERG, L.: Personal communication.
16. LERICHE, R.: *Presse Médicale*, 1940, **48**: 75.
17. *Idem*: *Mém. Acad. Chirg.*, 1940, **66**: 196.
18. LEWIS, SIR T.: Blood Vessels of the Human Skin and their Responses, Shaw & Sons, London, 1927.
19. *Idem*: *Brit. M. J.*, Dec. 20, 1941, p. 869.
20. MERK, C.: *Frankfurt Zeitsch. f. Path.*, 1927, **35**: 343.
21. MURPHY, H. L.: *Am. J. Surg.*, 1927, **36**: 370.
22. RICKER, G.: Pathologie als Naturwissenshaft, Julius Springer, Berlin, 1924.
23. SIMON, R. AND FILHOULAUD, H.: *Mém. Acad. Chir.*, 1940, **66**: 359.
24. SOUPAULT, R. AND ORSONI: *Mém. Acad. Chir.*, 1940, **66**: 358.
25. TANNENBURG, J. UND FISCHER-WASELS, B.: Handbuch der norm. and path. Physiol., 1927, Vol. 7, p. 1496.
26. THEIS, F. V.: *Arch. Phys. Therapy*, 1940, **21**: 663.
27. UFFREDUZZI, O.: *Int. Abstracts*, 1941, **73**: 166.

RÉSUMÉ

La conception moderne des engelures (trench foot et engelures des membres et de la face) a totalement modifié la thérapeutique de ces états. Le froid détermine la libération dans les tissus d'une substance "H" qui dilaterait les vaisseaux, augmentarait leur perméabilité et amènerait l'œdème. Puis s'installent la stase ou la thrombose locales responsables des ralentissements puis des arrêts circulatoires. Pour certains auteurs le vasospasme et l'hypertonie sympathique conduiraient aux mêmes engorgements circulatoires. Histologiquement on trouve de l'œdème avec infiltration périvasculaire de leucocytes et d'hématies. Les thérapeutiques proposées s'inspirent des principes généraux classiques, mais le mouvement actuel accorde la faveur aux injections paralysantes du sympathique et aux sympathectomies. Quelques thérapeutiques spéciales sont à l'étude: ondes courtes, vaso-dilatateurs, héparine, vitamines, réfrigération et gymnastique vasculaire passive. JEAN SAUCIER

A CONCEPTION OF NEURALGIC CHEST PAIN

BY MAJOR T. G. HEATON, R.C.A.M.C.

AMONG 341 consecutive cases referred to an army medical consulting clinic, 100 men complained of chest pain, and in 53 of these, the pain was a major, if not the chief, complaint.

In nearly all cases the pain was thought to have no serious significance, but that is not the point. The point is that we have here a common complaint, often the sole cause of disability, and we have no proper understanding of it. Medical schools almost ignore it and, in consequence, physicians are misled by it. For these reasons, and because these cases are being seen so abundantly, the writer felt that a study of this pain might be helpful.

Table I shows how frequently certain diagnoses were made in 100 consecutive cases of chest pain. Also, how frequently the same diagnoses were made in 241 medical cases without chest pain, seen consecutively in the same period of time.

TABLE I.

Diagnosis	*100 cases with chest pain so diagnosed* *percentage*	*241 cases without chest pain* *number*	*241 cases without chest pain* *percentage*
Spinal disease or injury.	4	2	0.9
Psychoneurosis	58	59	24.5
Subnormal mentality ...	14	15	6.2
Rheumatic diseases	10	14	5.8
Organic heart disease...	5	8	3.3
Malnutrition and convalescence	7	15	6.2
Lower respiratory tract disease	22	52	21.6
Functional dyspepsia ...	2	10	4.2
Peptic ulcer	0	10	4.2
Skin diseases	0	4	1.8
Intercostal neuralgia ...	16	0	0

The totals of the number of cases do not add up to 100 and 241 respectively, because often more than one diagnosis was made per case, and because some of the 241 cases were not classifiable under the diagnoses listed.

The diagnoses shown in Table I require a little explanation.

The term "psychoneurosis" includes all cases of functional nervous diseases, such as anxiety states, reactive depression, hysteria. It also includes cases to which the term "effort syndrome" was applied, because after careful study the writer could find no criteria by which effort syndrome could be distinguished as a separate entity. "Lower respiratory diseases" includes chronic and acute bronchitis, pneumonitis, and persons convalescent from pneumonia, pneumonitis, and acute bronchitis. "Malnutrition and convalescence" includes persons markedly underweight and those convalescent from acute illnesses other than lower respiratory diseases.

"Functional dyspepsia" is used to describe those cases in which gastric symptoms were the chief complaint and in which marked psychoneurotic manifestations were absent and in which no organic lesion could be found. "Intercostal neuralgia" describes the group in which chest pain was the chief complaint and in which the diagnosis of psychoneurosis was not made. The dividing lines between this group and psychoneurosis and effort syndrome were not clear. "Rheumatic diseases" includes rheumatic fever convalescents and various forms of chronic and acute arthritis.

In Table II the same statistical information is presented in another way.

TABLE II.

Diagnosis	*Number of cases*	*Percentage with chest pain*
Spinal disease or injury.....	6	67
Psychoneurosis	117	50
Subnormal mentality	29	50
Rheumatic diseases	24	42
Malnutrition and convalescence	22	35
Organic heart disease	12	33
Lower respiratory diseases ..	74	30
Functional dyspepsia	12	17
Peptic ulcer	10	0
Skin diseases	4	0
Intercostal neuralgia	16	100

Examination of Tables I and II reveals an evident link between the psychoneuroses and chest pain. This link might be strengthened by the inclusion of 9 of the group labelled "intercostal neuralgia", for a review of these histories showed that "psychoneurosis" might well have been diagnosed on the evidence.

The number of cases in the group of "spinal disease or injury" is too small to truly represent the relative importance of this group.

The tables seem also to indicate an association with diseases of the lower respiratory tract,

organic heart disease, malnutrition and convalescence, rheumatic diseases, and subnormal mentality. The group of "rheumatic diseases" included a considerable proportion of convalescents from rheumatic fever. It may have its significance chiefly as a group of convalescents.

Character of the pain.—An attempt was made to analyze the character of the pain in each of the chief groups shown in the preceding tables, in order to see if any difference could be detected in the pain in the various groups. The evidence obtained is summarized in Table III.

TABLE III.

	Psycho-neurosis	*Intercostal neuralgia*	*Lower respiratory tract disease*	*Organic heart disease*
No. of cases	58	16	22	5
Average age	26	26	26	24
Duration of pain—few days to few years, all groups				
Left side only ...	34	10	11	5
Right side only ..	5	2	5	0
Bilateral	12	4	4	0
Unstated	7	0	2	0
Related to deep breath or cough	5	4	6	1
Related to effort..	4	1	3	2
Related to movement or position	12	10	9	2
Unstated	37	1	4	0
Character, short and sharp	34	8	14	5
Aching and persistent	2	2	3	0
Both above	13	6	5	0
Unstated	9	0	0	0

There seems to be no difference in the pain between the groups shown in Table III. It is realized that it is difficult to make such a comparison in a statistical way. I can only add that in talking to these men it appeared to me that the pain was of the same character in all these groups. In the small group of spinal disease or injury a difference was noted. The pain was felt more commonly posteriorly or posterolaterally, whereas in the other groups the pain was anterior or antero-lateral. It is noteworthy, too, that in the group with organic heart disease the pain in all five cases has been on the left side only, but in character not distinguishable from the other groups.

A description of this pain as I have observed it in this series of 100 cases may now be given without any separate description for each group, since I think the pain to be the same for each group.

The pain is, with great regularity, described as being short or momentary in duration, sharp in character, "like a stab", often not severe, but, occasionally, of great severity—"all I can stand". One man said, "It's not severe but I can't stand it". It is quite frequently repeated in some cases, in others only rarely. There is often a prolonged dull ache in the same area, either alone or between sharp stabs. It is characteristically and usually provoked by such movements as reaching up, stooping over, rolling over in bed, but with no constancy. It may be relieved by a change in position, but with no constancy. It is often aggravated by deep breathing but never by quiet breathing; often also provoked by a cough. Less often it is brought on by running, by marching (especially with equipment), by walking quickly, by walking upstairs, or by walking downstairs. Men often say it is provoked by effort, but it often seems that it is really the movement incidental to effort which provokes the pain. It is sometimes provoked by excitement alone, sometimes by a jar, as when riding in a truck.

The pain is nearly always located in the anterolateral chest wall, and usually below the third rib. It is never substernal. It may rarely be lateral rather than anterolateral. It was not found to radiate to the neck or either arm in this series. It is much more often on the left than on the right side, and may be bilateral. When bilateral, it is felt at the same level on both sides. Intercostal tenderness was fairly often present in all groups, but seemed inconstant even in the individual case and to lack any diagnostic significance. The pain may be persistently recurrent for many years, and, in the severe chronic psychoneurotics especially, this is so. Or, it may be quite brief and transient. Pain of the above character is referred to below as "neuralgic".

Differential diagnosis.—The pain often presents a niee problem in differential diagnosis. One helpful point is that the electrocardiograph and x-ray provide only negative results.

In the present series of 100 cases an x-ray of the chest was made 36 times. In 26 the heart and lungs appeared normal. Three cases showed parenchymal inflammatory changes. In one of these the pain was on the side opposite to that of the lesion. Five films showed heavy bronchial and hilar shadows. In only two of these was a clinical diagnosis of bronchitis made. Four films showed evidence of pleuritis, presumed old. In three of these cases the pain was on the side opposite to the x-ray lesion. The fourth gave

a history of pleurisy with effusion; he had pain on the same side, and physical signs of an old pleuritis. One case showed a developmental anomaly of ribs and sternum. Another showed a prominent pulmonary conus. In all other cases x-rayed the heart was of normal size and shape.

X-ray of spine was made in 12 cases; was entirely negative in 8, and showed slight osteophyte formation in 4 men aged 37, 46, 33, and 45 respectively. A fracture of a 2nd lumbar transverse process was shown in one of these. Gall bladder or gastro-duodenal x-rays in 3 cases were entirely negative.

The electrocardiographic tracing was made in 15 cases. In two, extra systoles were noted. In one, a slight right axis deviation was present. One case of clinical coronary thrombosis had changes characteristic of this condition and in addition to the characteristic pain, had breast pain similar to the pain we have been describing.

Blood sedimentation rate was normal in 2 cases; 30 mm. in one hour in a case of "fibrositis" of the back.

In the differential diagnosis of chest pain a number of different conditions may have to be considered. The commonest of these are: pleurisy, organic heart disease, coronary thrombosis.

Pleurisy.—It is noteworthy that no case of active pleurisy was encountered in this series of out-patients. The reason, of course, is that most patients with pleurisy are ill. They are hospital cases, nearly always febrile. This I think the most important differential point, apart from the hearing of a friction rub. These "neuralgic" pains may occur on deep breathing or coughing, as pleural pains do, but are not related to quiet breathing as pleural pain *may* be. Pleural pain *may* be related to movement, as these neuralgic pains usually are. The prolonged dull ache between sharp pains is more characteristic of "neuralgic" pain than of pleural. Neuralgic pain is persistently recurrent over a longer period of time than is pleural pain. Pleural adhesions are often blamed for pain. I do not think that the pain in cases in which pleural adhesions may be suspected can be differentiated from the neuralgic chest pains here described. It is certainly true that where pleural adhesions are known to be present they are usually painless.

Organic heart disease.—Authorities are agreed on the general point that some cases of organic heart disease are associated with pain in the left anterolateral chest. This study agrees with this statement. I think, however, that the left chest pain found associated with some cases of organic heart disease can in no way be distinguished from the "neuralgic" pains here described and which in most cases do not appear to be associated with heart disease. The pain in cases of organic heart trouble, however, seems usually, if not invariably, to occur on the left side. But left-sided pain of this type is much more commonly found without, than with, demonstrable organic heart disease.

Two patients seen at a later date than the present series had pain of the neuralgic type, without demonstrable organic heart disease, and felt at the same time in the left anterolateral chest and referred down the left arm and to the left shoulder. Such cases present a difficult problem in diagnosis.

Effort syndrome. — In this place it may be well to add a few words about "effort syndrome". This diagnosis was made in 19 cases in the series. It could with equal right have been made in many more. Reviewing these histories it would seem that the making of this diagnosis was more indicative of a mental bias on the part of patient, or examiner, or both, than of any real difference between the cases of effort syndrome and those labelled psychoneurosis, or intercostal neuralgia.

Coronary thrombosis.—The pain of coronary thrombosis, though subject to variations, is well known and sufficiently characteristic. It need not be described here. In cases of coronary thrombosis in the healed or healing stages, however, pains occur which are often indistinguishable from the chest pains here described as "neuralgic". These are nearly always left-sided, and are often referred to the left shoulder or down the left arm, and are not related to effort.

Osteoarthritis of spine.—Only in this group was there noted any characteristic to distinguish the pain of this group from the pain in other groups. The pain was usually posterolateral where there was evidence of spinal disease, and anterolateral in all the other groups. Nevertheless, the relationship of the osteophyte formation seen in x-ray to the pain, is not clear because of the frequent presence of osteophyte formation without pain. Osteophyte formation may be very extensive without pain.

Neuritis.—True intercostal neuritis with sensory changes is a very rare disease. If the

presence of osteophytes caused pain by pressure on nerves one would expect neuritis to be common. Our series contained just one case of a segmental neuritis. In this case, a man of 45 years, the pain was located in the left loin and hypochondrium. A band of hypo-æsthesia extended from about one inch from the spinous processes to about one inch from the mid-line of the abdomen in the region of the pain. The upper left abdominal reflex was much reduced. The others were active. He was also a psychoneurotic with subnormal intelligence and he had a double ureter on the left side and a very little osteophyte formation according to the spinal x-ray. He had no chest pain and is not included in the 100 cases under discussion. The findings were confirmed on several occasions, by two different examiners.

Intercostal neuritis with sensory changes was not found in this series of 100 cases of chest pain. Neuralgic abdominal pain had led to appendectomy in one case.

THE NATURE OF THE PAIN

We are accustomed to the idea of local pain produced by local damage. This is simple and seems easily understandable. We accept, with less understanding, the idea that visceral pain may have a rather wide area of peripheral reference. But we treat as if it did not exist this common pain here discussed. We shrug it off as "not significant", or, we call it "pleurodynia", to conceal our ignorance.

If an explanation of this chest pain be attempted, it must explain (*a*) its increased frequency in emotionally unstable persons in whom it may be *provoked* by excitement alone; (*b*) its association with organic thoracic disease; (*c*) its occasional occurrence without evident emotional instability and without evident intrathoracic disease (intercostal neuralgia); (*d*) the effect of movement in provoking pain.

It is probable that pain may be produced by a summation of factors, which may vary in relative importance in different cases, and yet produce the same pain. Such factors may be: (1) the appreciation of stimuli as painful (central); (2) the excitability of the peripheral nerve endings; (3) the action of reflex mechanisms for the production of referred pain; (4) direct action of toxic or mechanical factors upon the pathways of pain. Doubtless all these factors interact upon each other. Doubtless, too, each one depends on a number of sub-factors also mutually interdependent.

Regarding such examples as the chest pain of the psychoneurotics and cases of effort syndrome, I think we must admit the existence of a "functional" pain, based chiefly on overappreciation of an over-excitable pain mechanism and with the site of the pain determined by the "conditioning" of a spinal segment by old or recent visceral disease or even visceral dysfunction in the absence of organic disease.

The over-acting heart, for example, is frequently associated with this neuralgic type of left-sided chest pain and it is my suggestion that this overaction may determine the location of pain in patients with over-excitable nervous tissue. This may explain the higher incidence of left- than right-sided pain.

There is some evidence that the sympathetic nervous system is involved locally in these cases. One patient with pain of neuralgic character about the costal margins complained also of a stinging sensation in palms of hands and intermittent swelling of the hands, and had a persistent patchy reddish marking of the skin at the site of pain, over the lower left intercostal spaces laterally. Another man complained of a persistent cold feeling in the region of pain and the examiner's hand could easily feel that the site of pain was cooler to the touch than the skin above or below this level. The same coolness was noted by the examiner at the corresponding level of the opposite side, though the patient had not himself felt cold on the opposite side. It seems probable that temperature changes of this kind might be noted more commonly if searched for.

The effect of movement in provoking the pain may be thought of as a purely mechanical effect upon an over-excitable pathway.

The conception I hold of these pains is that they are pains of essentially similar nature, sharing a common mechanism of production, though this mechanism may be operated by different factors in different cases. The pain itself is more deserving of a name than are the factors which determine its occurrence and location, since these factors are multiple and not necessarily themselves of the nature of progressive organic disease. Two names are in use which are vague enough to be sufficiently inclusive. These are "neuralgia" and "causalgia". The latter term has a rather limited connotation at present, so that I think "neuralgia" preferable

as a name for these pains. Though this study deals with chest pain especially, I am satisfied that pains of similar nature and mechanism occur in the abdomen and limbs, and that there is no clear division between this pain and limb causalgias.

One should, I think, speak of "psychoneurosis with neuralgic pain", or "organic heart disease with neuralgic pain", or "chronic pleurisy with neuralgic pain", or "unresolved pneumonia with neuralgic pain", or "intercostal neuralgia", where the underlying factor is not known. Effort syndrome, I think, should be termed "psychoneurosis with neuralgic pain".

The term "neuritis" should be reserved strictly for cases showing one or more of muscle wasting, muscle weakness, reflex changes, and sensory changes of constant and anatomically explicable distribution. "Causalgia" may be reserved for cases showing one or more of œdema, temperature changes, colour changes, in addition to evidence of "neuritis".

The incidence of chest pain in this series of consecutive consultations is so high as to be surprising to the writer and no doubt will be surprising to others. The inclination is to wonder if something is not wrong about the whole business, and perhaps, to suspect me of being deliberately misled by my patients! For my part, I am satisfied there is no element of malingering in the picture. These men come from various sources, very few of them reap any personal benefit from their chest pain, and, after seeing many hundred more patients since the end of the period covered by the study, I am sure that the incidence of chest pain is still high. Furthermore, the description of the pain is so uniformly given throughout that it seems sure that individual invention is not operating.

One explanation of the high incidence of chest pain reported is that I was early attracted by the frequency of the complaint, and in taking the history have made it a routine practice to ask the man whether he has had chest pain. Many cases in which chest pain was not a major complaint were thereby discovered. I believe the high incidence of chest pain in this series is due to the large proportion of psychoneurotics in the series. One is tempted to speculate on a possible influence of vitamin deficiency in the production of the pain. Many psychoneurotics are malnourished and select their foods badly.

It has long been recognized that psychoneurotics have pains. It has become customary to call these pains "vague". This word in this connection is a transferred epithet. The pain is not vague. The vagueness applies to the examiner's intellectual processes when he terms it so. This pain is, on the contrary, quite definitely and uniformly described and does not differ in character from intercostal neuralgia, the pain in effort syndrome, the pain in some cases of organic heart and lung disease, or the pain in some cases of adhesive pleurisy. There *are* vague pains in psychoneurotics, but they are unusual and limited to those who have hysterical manifestations or who are deliberate malingerers. The vagueness of the neuralgic pain in psychoneurotics is more apparent than real. These men tend to be vague about everything, to use many adjectives, to dramatize their illness, but they do locate their pain constantly and it seems not to differ in character or location from pain described by persons without evident psychoneurosis.

Could some of these pains be due to fibrositis, or myositis? Pain made worse by movement might suggest such a cause. Against this, I think, is the fact that when such pains are bilateral the same level is affected on both sides. Against this too is the usual absence, or inconstantly located presence, of local tenderness. Also against it is the normal sedimentation rate.

Carnett,[1] though referring especially to abdominal pain, says neuralgic pain is "very frequent" and that a "large percentage" of these patients are neurotic. Smith and Bates[2] say "neuralgia of the 4th to 6th thoracic trunks may simulate pleurisy and mastitis and on the left side, cardiac pain, especially when filaments from the fourth trunk, entering the brachial plexus, may send painful stimuli to the arm".

Speaking of the relationship of visceral disease to referred pain, these authors say "closer clinico-pathological correlation of more recent years has failed to bear out this constant relationship between intra-abdominal lesions and superficial pain and a state of confusion has developed regarding its significance. The majority of cases of abdominal wall pain and tenderness are definitely not associated with intra-abdominal disease". Also, "Davis examined 250 boys and girls with abdominal pain and found that only 9% were due to intra-abdominal lesions".

Pottenger[3] writes "Recurrent pain may occur in the neurons associated with any viscus that has been the seat of prolonged inflammation or

possibly prolonged irritation without inflammation. It has the same segmental characteristics as the more acute pain and is sometimes difficult to differentiate from it (*i.e.* from the referred pain of visceral disease). It seems that there is an inability on the part of these injured neurons to adapt themselves to unusual requirements of physiological adjustment, whether originating in the external or in the internal environment. The change in sensibility is manifest under many conditions, such as changes in the weather, seasonal changes, tiring, such depressive emotions as worry, discontent, and unhappiness, and during menstruation. This type of pain is inadequately appreciated. It causes both physicians and patients much needless anxiety and results in operation when no serious danger exists''.

CONCLUSIONS AND SUMMARY

1. A common type of chest pain is described and is termed ''neuralgic''.

2. Neuralgic pain is the commonest chest pain.

3. It is associated with emotional instability, old or recent organic disease of heart and lungs, debilitated and rheumatic states, and possibly with disease of the vertebral column.

4. The same pain may occur in the *apparent* absence of all these conditions, and any of these conditions may be present without this type of chest pain.

5. The pain in ''chronic pleuritis'', ''effort syndrome'', and some cases of organic disease of heart and lung cannot be differentiated in character from these neuralgic pains.

6. These pains are commonly mis-diagnosed as ''pleurisy'' or ''heart disease'', and when the same type of pain occurs in the abdomen, as ''appendicitis'' or ''kidney trouble''.

7. The prognosis varies greatly, being worst in chronic psychoneurotics. The pain is, on rare occasions, a moderately severe disability in itself.

REFERENCES

1. CARNETT, J. B.: Intercostal neuralgia as a cause of abdominal pain and tenderness, *Surg., Gyn. & Obst.*, 1926, **42**: 625.

2. SMITH, D. W. AND BATES, W.: The surgical significance of abdominal wall pain, *Surgery*, 1941, **9**: 741.

3. POTTENGER, F. M.: Clinical aspects of abdominal pain, *J. Am. M. Ass.*, 1934, **102**: 341.

ABSCESS OF THE LUNG*

BY ROBERT M. JANES

Toronto

REPORTS of strikingly improved results in the treatment of any condition, particularly if those reports emanate from several observers and from different clinics, always suggest that we should review our own material to discover whether we are doing the best that can be done for our patients. Because of the very excellent results that have been reported more recently[4, 5, 6] it was felt that a survey of the histories of a series of cases of abscess of the lung should be undertaken. A few cases that were obviously of a fulminating type and hopeless from the beginning, multiple small abscesses complicating general blood infections, and small abscesses discovered only at autopsy were excluded from the series. The 106 cases studied were admitted to the Toronto General Hospital over an eight-year period, 1933 to 1940. A comparison between our results, a representative series by King and Lord[7] and more recent figures by Neuhof and Tourof and Betts is readily made by reference to Table I and at once suggests

TABLE I.
COMPARATIVE MORTALITY FIGURES

	T.G.H. 1940	*King and Lord* 1934	*Neuhof and Tourof* 1940	*Betts* 1941
No. of cases	106	210	100	24
Cured	54%	40%	96%	96%
Improved	9%	0	0	0
Unimproved	2%	0	0	0
Dead	34%	35%	4%	4%

that there must have been something wrong in the diagnosis or treatment, or diagnosis and treatment of the earlier cases.

ETIOLOGY

In Table II is given an analysis of our cases under the usual etiological factors. The aspiration group included for the most part those cases

* From the Department of Surgery, University of Toronto and the Toronto General Hospital.

Presented at the Academy of Medicine (Section of Surgery), Toronto, January 20, 1942.

TABLE II.

ETIOLOGY OF LUNG ABSCESS (106 CASES)

Aspiration	30%
Pneumonia	35%
Idiopathic	22%
Embolism (septic 5 cases, sterile 6 cases)	10%
Trauma	1%
Perforation of adjacent lesion (œsophagus 1, subphrenic 1)	2%

Those that complicated carcinoma or adenoma of the bronchus were excluded.

which followed tonsillectomy, extraction of teeth, other operations on the upper respiratory tract, general anæsthetics administered for general surgical procedures, and a few in which there was a fairly frank history of aspiration of material such as vomitus. After reading the histories one was often at a loss to know whether a particular case should be placed in the pneumonia, the aspiration or the idiopathic group. The reasons for the diagnosis of pneumonia were often obscure and the modes of onset differed in no way from those that had followed a definite aspiration. Indeed, it seemed reasonably certain that the actual etiological factor in nearly all the cases under these three headings had been aspiration of septic material. This opinion has been expressed recently by Betts.[4] How easily material may be aspirated unknowingly into the bronchial tree was shown by Faulkner and Faulkner.[8] In actual fact one need only recall the quantities of purulent material that the patient suffering from an acute suppurative sinusitis coughs out of his bronchial tree on first awaking, to realize that the cause for wonder is not that a few individuals should develop pulmonary foci but that many more do not do so. That the first sputum examined nearly always contained several organisms suggested that the condition had been initiated by aspiration. The occurrence of lung abscess as a complication of an ordinary pneumonia due to a pure pneumococcus or streptococcus infection is probably rare. This is possibly not true of staphylococcus, although the abscesses from which a pure culture of staphylococcus was obtained in this series were associated with a frank septicæmia or pyæmia.

It would seem that the probable course of events following the obstruction of a pulmonary vessel by a sterile embolus is extravasation of blood and fluid into the surrounding tissues, with œdema of adjacent bronchial walls and increase of intrabronchial secretion. Such debilitated tissue then forms an excellent culture medium for infective organisms reaching it by way of the air passages, or by the much less frequent source, the blood stream.

A few abscesses of the lung seem to have followed definitely an injury to the chest, usually a severe blow or a severe crush. One can conceive of several ways in which an injury might predispose to infection of lung tissue. In the first place, as a result of a diffuse extravasation of blood into the lung tissue, a condition similar to that which follows the lodging of a sterile embolus might exist; again, infection of a frank collection of blood in the lung tissue such as that reported by Fallon[9] might occur, and, as a third possibility, pain as a result of the injury, particularly if ribs have been fractured, might interfere with coughing and the clearing of secretions, thus predisposing to pulmonary infection.

Abscesses that result from perforation of adjacent septic foci into the lung are uncommon. Those that come from the mediastinum are almost invariably fatal and not amenable to treatment; those that occur as a result of perforation of a subphrenic abscess into an adherent lower lobe of the lung recover spontaneously as a rule if the subphrenic space is drained adequately. Abscesses secondary to carcinoma or adenoma of the bronchus must be kept in mind but will be considered only incidentally in this paper.

PATHOLOGY

It seems likely that the essential points in the pathology of this condition have been stated by Betts.[4] He has called attention to the close relationship that exists between the bronchus and blood vessels of a pulmonary lobule. A bit of septic material lodging in such a bronchus results first in atelectasis of the small segment of lung supplied, and, later, when the organisms gain a foothold, in thrombosis of the vessels. Such a series of events would explain the frequent finding of masses of necrotic material

TABLE III.

LOCATION OF ABSCESSES

(Based upon 89 cases in which the location seemed reasonably certain)

Right upper	34%	
Right lower	29%	
Right middle	2%	
		65%
Left upper	14%	
Left lower	21%	
		35%

in these abscesses. This means that all lung abscesses must be near some point on the surface of the lung and face chest wall, mediastinum, interlobar fissure or diaphragm. The segmental distribution of the bronchi has been described by Nelson[2, 3] and Glass.[1] Space does not permit of a detailed description of them, but a knowledge of these special bronchopulmonary segments is essential to a proper understanding of the pathology, anatomical localization and treatment of abscess of the lung. In a recent careful analysis of 100 cases Glass found that in only 3 did the abscess lie in the segment having only a diaphragmatic and mediastinal surface.[1] All others were accessible for drainage. Since the shell of lung overlying the abscess is so thin, rarely more than one-half to three-quarters of an inch, the overlying pleura becomes involved early in all cases, pleural pain is a common symptom and the formation of adhesions between the overlying visceral and parietal pleura is an early occurrence. Because the abscesses occur in the periphery of the lung the bronchi with which they establish communication are invariably small, rarely exceeding 2 to 3 mm. in diameter.

Central lung abscesses are very uncommon and probably occur only as a result of the breaking down of a new growth or from local ulceration about a large foreign body. The apparent necessity of traversing a thick layer of seemingly normal lung tissue in draining an abscess indicates that localization has been faulty and that the abscess is nearer the surface at some other point. The thin layer of pulmonary tissue overlying the abscess bleeds little when incised, since many of its blood vessels are thrombosed.

If this interpretation of the pathology is correct it follows that the tendency is for most primary abscesses of the lung to be single. Only those due to a massive aspiration or to the occurrence of numerous septic emboli are likely to be multiple. Multiloculation is the result of an extension of the process about the margins of the original focus. Secondary abscesses may occur at any time as a result of aspiration of material from the abscess into bronchi of the same or other pulmonary segments. As the abscess becomes chronic there is increasing fibrosis and destruction of the surrounding lung tissue and the formation of a rigid wall which will not collapse following drainage. In certain abscesses partial or complete epithelization from the bronchus occurs. Varying degrees of permanent dilatation in the neighbouring bronchi develop and the symptoms of bronchiectasis are added to those of chronic abscess. When these secondary changes occur spontaneous recovery is impossible and simple drainage will not effect a cure.

BACTERIOLOGY

The most striking thing about the bacteriology of lung abscess is the multiplicity of organisms found, and the fact that each abscess contains more than one type of bacteria. Abscesses that result from septic emboli containing a specific organism and cases of staphylococcus pneumonia that have gone on to abscess-formation constitute an exception to this general rule. In a series of cases in which bacterial examinations were made the following organisms occurred, with the frequency indicated. *S. viridans,* 29; *Staphylococcus,* 23; *M. pharyngis siccus,* 14; *S. hæmolyticus,* 12; pneumococcus, 11; fusiform bacilli and spirochætes, 12; unidentified M. catarrhalis, 5; anaerobic streptococcus, 9; non-hæmolytic streptococcus, 6; diphtheroid bacillus, 5; *B. pyocyaneus,* 4; Friedländer's bacillus, 2; *B. coli,* 1.

DIAGNOSIS

History.—In the great majority of cases the onset is insidious. The patient often feels generally miserable with malaise and loss of energy; there is usually a mild fever and occasionally chills. Pain in the chest on breathing is not an infrequent symptom; cough is less common and, when present, is slight in degree. At the end of one to three weeks, but occasionally even later, the cough becomes productive and purulent sputum in gradually increasing amounts is raised. This material may be streaked with blood. Gross hæmoptysis is not uncommon and may indeed be the first symptom. If the lesion follows an operation on the upper respiratory tract there is often a fairly definite history of the development of chest pain and fever a few days after operation. At the end of one to two weeks the patient suddenly coughs up a quantity of sputum. Those cases that result from pulmonary infarction usually give a history of the sudden onset of chest pain, difficulty in breathing, and cyanosis. Instead of recovering fairly rapidly, as do most cases that do not die as a result of the size of the embolus and escape infection, there is a gradually increasing

fever and finally the production of purulent sputum. Some of these patients have bloody sputum immediately following the infarction.

Physical findings. — Perhaps the thing that should be emphasized most in regard to the physical findings is their paucity; indeed there may be no abnormal findings at all. As in many other diseases of the chest one is impressed by the few abnormal physical signs to be found in the presence of even very extensive pathological changes in the lung. On the other hand, a careful physical examination of the chest is always important and often helps greatly in the interpretation of the roentgenograms and localization of the lesion. A point of tenderness on the chest wall where the abscess is nearest to the surface, when present, is a valuable sign. The most constant finding is an area of localized dullness and râles.

X-ray.—Roentgenological examination of the chest is not only the most important method of diagnosis of the disease but the best way of following its progress. Films taken very early may present no abnormality or only a very small parenchymal shadow sometimes associated with a slight increase in the height of the diaphragm on the affected side. As the infiltrative changes in the lung increase the shadow cast becomes larger and more definite. It differs from that found in most ordinary pneumonias in being more localized as a result of the changes being confined to one or other of the broncho-pulmonary segments. A fluid level does not, of course, appear until some of the contents of the abscess have been evacuated into a bronchus and the entry of air permitted. This point requires emphasis. The absence of a fluid level does not mean that the patient has not got an abscess. When the lesion has become chronic a cavity may not be seen in the ordinary exposure because of the denseness of the infiltration that surrounds it. Such cavities may be demonstrated in Bucky diaphragm films or, still better, with the laminograph. Postero-anterior and lateral films are best for accurate localization of the lesion, but here again laminography often gives invaluable assistance. In more chronic cases x-rays following the introduction of lipiodol are important in determining the extent of the changes in the surrounding bronchi. Lipiodol can rarely be introduced into the abscess cavity.

Bronchoscopy is important in the exclusion of foreign bodies and new growths of the bronchi. Bits of beef, chicken or fish bones may have been aspirated without the patient's knowledge. They rarely show in the x-ray. In addition, the bronchoscopic findings aid in localizing the disease. Whether the pus is coming from the upper, lower or middle lobe bronchus can always be determined. In addition to the escape of pus the degree of redness and œdema of the bronchial mucous membrane suggests the area most affected.

Examination of the sputum is necessary for the exclusion of specific infections, particularly tuberculosis and fungi. The very rare occurrence of a syphilitic lesion of the lung should be remembered.

Differential diagnosis.—A carefully taken history is of the greatest value. The primary lesion may be a carcinoma or adenoma of the bronchus. The majority of these may be seen through a bronchoscope, but those placed more distally may not be visible, in which case it must be considered that the lesion is an ordinary abscess. The subsequent progress of the case may demonstrate that this diagnosis was wrong.

An *empyema* from which a bronchial fistula has developed may be confused with abscess on history alone, but it is recognized readily by physical examination and x-ray. The presence of foul pus in the pleural cavity usually means that the original lesion was an abscess. This suggestion is confirmed by the history. The original abscess may or may not be recognizable in the x-ray at this stage.

Infected dermoids and *pulmonary cysts* may simulate simple abscesses. The presence of hair and detritus in the sputum in conjunction with a careful study of the x-ray pictures will generally result in recognition of the former. The presence in the x-ray of other translucent areas usually suggests the diagnosis in the case of *multiple cysts.* If the cyst be single its true nature may be recognized only at operation or when a portion of the wall has been obtained for microscopic examination.

TREATMENT

The early treatment is similar to that of pneumonia, including a trial of sulfonamide therapy. Drug therapy is unlikely to effect a cure, but the clinical condition of the patient may be improved because of the effect on the spreading infection in the surrounding lung tissue. If a connection with a bronchus has been established

and sputum is being produced postural drainage should be instituted. Drainage should be repeated several times daily, depending on its effectiveness and the condition of the patient.

Bronchoscopy is of chief value in the diagnosis and localization of the lesion. It may in some cases improve the drainage, but at best, because of the pathology of the condition, can do little more. Repeated bronchoscopies should not be allowed to become a substitute for more effective treatment.

Pneumothorax, while occasionally accomplishing a brilliant cure, is a dangerous procedure and its use should be discontinued. The lesion is a superficial one, the abscess being covered by only a thin layer of poorly nourished lung. If an empyema is not produced immediately by a tearing of the superficial covering of the abscess it is likely to occur later, because the abscess has been deprived of the support of the chest wall. Empyema occurred twenty-five times in this series and in those in which it was possible only to drain the empyema the mortality was nearly 50%. Paralysis of the diaphragm more frequently interferes with than promotes escape of the contents of the abscess.

The only really effective treatment for those cases that do not recover promptly with medical measures is external drainage. Because much of the content of most abscesses is semi-solid necrotic and fibrinous material which cannot escape through small bronchi until liquefied, it is surprising that so many patients recover without surgical intervention. In this series of 106 cases only 20 recovered spontaneously, 5 showed improvement on leaving hospital and in most instances would probably recover incompletely, a recovery rate of less than 25%.

No hard and fast rule can be established as to the time that should be allowed to elapse before surgical drainage is undertaken. In general it may be said that all abscesses that are not showing unmistakable evidence of getting well should be drained at the end of 5 to 6 weeks. On the other hand, some should be drained much earlier if the clinical course is unfavourable. If the patient is becoming increasingly ill and the x-ray shows a diffuse shadow only, the establishment of a bronchial communication and production of a fluid level should not be awaited. Such a patient's best and perhaps only hope lies in effective drainage. No attempt can be made here to describe in detail the operation for drainage. The first essential is an accurate localization of the lesion in relation to the chest wall. The operation is done most safely, and usually without too much difficulty, under local anæsthesia. Experience has shown that the lesser surgical procedures are most effective and that resection of a portion of one rib only is sufficient. Adhesions of the pleura having been demonstrated, a large needle is inserted into the cavity and the overlying thin segment of lung traversed either with a scalpel or cautery. The use of continuous suction to remove blood and the fluid content of the cavity and, if general anæsthesia has been necessary, the employment of some positive pressure, decrease the chance of aspiration. The interior of the cavity should be visualized if possible and all solid material removed. If the opening of a secondary locule into the main cavity is recognized it should be enlarged. The cavity is packed loosely with gauze with or without the addition of a tube. The wound in the chest wall should be packed open and under no circumstances closed about a drainage tube, since this may permit the forcing of air and infected material into areolar tissues and the occurrence of a virulent form of spreading cellulitis. Liberal smearing of the tissues of the chest wall with bipp before the abscess is opened into lessens the likelihood of this most serious complication. If open pleura is encountered, or it proves necessary to traverse a considerable thickness of lung tissue to enter the abscess, the approach has probably been incorrectly planned. The gauze packing is changed every second day or daily, depending on necessity, the indications usually being fever and the production of sputum. Drainage is continued until the cavity has disappeared and best until the fistula has closed.

Thoracoplasty is occasionally necessary to close large apical cavities that are not obliterated following drainage. It should be used rarely as a sole method of treatment, since it is unlikely to produce a complete cure.

Chronic cases in which the abscess has become multiloculated, secondary bronchiectasis has developed, extensive fibrosis of the surrounding lung tissue has occurred, or in which the abscess cavity has become partially or completely epithelized, cannot be cured by drainage alone. It is, in addition, in these cases that complications are frequent and mortality high. Such cases should be treated by lobectomy or in a few instances in which both upper and

lower lobes are involved, by pneumonectomy. Our experience would seem to show that these procedures are not only much more likely to effect a cure but that they are followed by a lower mortality. Excision of the upper lobe for such chronic lesions is a much more difficult and serious undertaking than excision of the lower lobe.

SUMMARY

1. The majority of pulmonary abscesses result from aspiration.

2. Septic and sterile emboli were the etiological factor in 10% of this series.

3. A knowledge of the anatomical distribution of the bronchi is helpful in understanding the pathology and probable location of lung abscesses.

4. The bacterial flora of the majority of lung abscesses is a mixed one, in which anaerobes are prominent, the only exceptions being those that arise from septic emboli and from pneumonia produced by a single organism.

5. Recovery of a large percentage of abscesses with medical treatment alone is not to be expected, because of the small calibre of the bronchi with which communication is established and the semi-solid content of many of them.

6. External drainage should be established in all cases not showing a definite tendency to get well at the end of five to six weeks and in some cases in which the clinical and x-ray course is unfavourable, even earlier.

7. The pathological changes that occur with chronicity make spontaneous recovery and cure by drainage alone unlikely. Such cases should be treated by lobectomy or, occasionally, by pneumonectomy.

REFERENCES

1. GLASS, A.: *Surgery*, 1941, **10**: 465.
2. NELSON, H. P.: *J. Anat.*, 1932, **66**: Pt. 2, 228.
3. *Idem*: *Brit. M. J.*, 1934, **2**: 251.
4. BETTS, R. H.: *Am. J. Surg.*, 1941, **54**: 82.
5. NEUHOF, H., TOUROF, A. AND AUGSES, A. H.: *Ann. Surg.*, 1941, **113**: 209.
6. NEUHOF, H. AND TOUROF, A.: *N. Y. State J. Med.*, 1940, **40**: 849.
7. KING, D. S. AND LORD, F. T.: *Ann. Int. Med.*, 1934, **8**: 468.
8. FAULKNER, W. B., JR. AND FAULKNER, E. E.: *Am. J. M. Sc.*, 1932, **184**: 370.
9. FALLON, M.: *Brit. J. Surg.*, 1940, **28**: 39.

CHRONIC INFECTIVE ARTHRITIS CAUSED BY PSEUDOMONAS PYOCYANEA

BY P. E. FISET, B.A., M.D.*

Quebec

DURING these past few years medical literature has been enriched by contributions concerning the pathogenicity of *Pseudomonas pyocyanea*, or *B. pyocyaneus*.

Since the work of Gessard who first isolated this bacillus in 1882, and that of Jordan, who studied its varieties, the few observations published to date prove that this organism produces localized infections, in order of frequency, in the middle-ear, the skin, and the alimentary mucosa (Lartigan[6]). The respiratory tract, eyes, joints, kidneys, meninges,[7] liver (Kruse and Pasquale[6]), are occasionally affected. This bacillus can also cause generalized infections, acute and fatal, particularly in infants. Wassermann reports an epidemic with eleven deaths of generalized infection starting in the umbilicus of the new-born. Krombals[6] refers to seven cases of generalized infection by *B. pyocyaneus* and reports an eighth from his personal experience.

We append a detailed description of a case which presents certain immunological interest.

CASE REPORT

In September, 1938, we examined a patient 77 years old, almost completely impotent, bed-ridden, emaciated, and aged, suffering for about ten years from chronic articular rheumatism, that had gradually become aggravated.

He complained of varying pains in his joints. There was a slight peri-articular œdema, an apparent muscular atrophy in the limbs, and a light deforming hypertrophy of the small articulations, mainly of the fingers. Passive movements induced contractions. Standing, he presented a simian appearance, his back was curved, the limbs semi-flexed, and his walk consisted in dragging his feet with lateral movements of the body. He could not dress unaided, nor even button his clothes.

His personal and family history was of no special interest. He was a farmer in the State of Vermont, and fixed the date of his first symptoms while working at an old sewage system.

Physical examination.—Sense organs apparently normal. Tonsils normal, coated tongue, foul breath, double denture. Occasional cough, but no sputum. The lungs showed a few sibilant râles. Blood pressure normal, pulse 90, heart and vessels normal. Blood count: 3,960,000 red blood cells, 10,600 white blood cells.

* Ex-Chief Bacteriologist of Montreal Provincial Laboratory. Bacteriologist, Department of Pensions and National Health at Quebec.

Differential blood count: lymphocytes 52%. There was occasional insomnia and headache. He rose once nightly to urinate. The routine examination of the urine was normal. There was a slight hypertrophy of the prostate. For many years he has worn on the right side a truss that satisfactorily supported an incomplete, oblique inguinal hernia. The abdomen was painful to pressure; no defined MacBurney point. Anorexia was marked, there was alternate constipation and mild diarrhœa. Temperature varied between 99 and 100°.

At first we took it to be a chronic infective arthritis. These clinical findings did not permit us to seriously consider other forms of chronic articular rheumatism. A special physical examination was again carried out, to find the suspected focus of infection. Tonsils, dental roots, sinuses, ears, were normal. Chronic appendicitis was suspected, but the age and state of the patient contraindicated any major operation. It was probable that the cause lay in the intestine for the following reasons: coated tongue, foul breath, anorexia, periods of constipation and diarrhœa, abdominal tenderness, afternoon temperature of 99 and 100°.

A study of the intestinal bacterial flora was made. A series of six samples of fæces was inoculated on different media to cultivate any possible microbe classified in the Salmonella and dysentery groups. *Ps. pyocyanea* which grew in striking abundance was isolated and identified. Though this microbe is quite frequently isolated from the alimentary tract of healthy persons, and is considered more or less inoffensive, the pathogenity of this strain required a test.

One c.c. of 24-hour broth culture was subcutaneously inoculated into a guinea pig. The animal died within 22 hours. Extensive inflammatory œdema, purulent infiltration of the tissue, and serous fluid in the abdominal cavity were observed at the autopsy. This virulent pseudomonas was re-isolated from the urine, blood, and abdominal fluid of the dead animal.

The macroscopic agglutination test, following the Dreyer-Gardner technique was performed with the patient's serum and the isolated *Ps. pyocyanea*. A standard agglutination was obtained with a dilution of 1/600. Control revealed no auto-agglutinin. The possibility that this strain might be very easily agglutinated by normal human serum was checked. Fifty-one different sera (40 normal, 5 Wassermann strongly positive, 6 typhoid-positive) did not agglutinate the *Ps. pyocyanea* at a rate higher than 1/20, which is considered the normal rate.[5]

The patient was therefore, without any doubt, suffering from an infection caused by *Ps. pyocyanea*. He was infected in all probability ten years before while working at a sewage system, a favourite medium of this bacillus.

The destruction of this pathogenic agent clearly was the object of treatment. Considering the innumerable intestinal villi, and the strong resistance to antiseptics of the *Ps. pyocyanea*, the task of destroying it did not appear an easy one. Lactic ferments were considered, but the bacterial antagonism, and the supremacy of the *Ps. pyocyanea* contraindicated its trial. A biological method based on the work of Torikata and Shakudo[8] was adopted. Their experiments on rabbits regarding the immunization against *Ps. pyocyanea* by oral administration, led us to try this method on a human subject.

Having only the summary of their experiments published in the *Bulletin de l'Institut Pasteur*, and as a translation of the original was not immediately available, therefore, a special technique for preparing an auto-vaccine was outlined. In other respects the patient was only too anxious for results.

Ps. pyocyanea belongs to the Gram-negative bacteria group, in which Boivin and Mesrabeanu[2] have been able to show the existence of a strongly antigenic "glucido-lipidic" complex which represents the complete somatic antigen O and endotoxin of the bacteria. In general, endotoxin or somatic antigen O is more thermostable than exotoxin and antigen H. Likewise, certain exotoxins of which the composition is similar to polysaccharidic haptens are rather thermolabile.

The antigenic effectiveness of the somatic antigen O of *Ps. pyocyanea* is well defined[1] but data on the antigenic power of antigen H and other toxins of this bacillus are not so clearly established. Since the vaccine was to be administered orally, there was no objection to utilize the complete microbe, in accordance with the old but true principle of Pasteur.

On nutrient agar media, the S and R colonies appeared in irregular proportion. The antigenic action of S and R colonies is known to be habitually different. To obtain the most effective immunization action of the vaccine, both colonies S and R were separately cultivated, then approximately equally mixed.

For sterilization, in order to avoid destruction of certain thermolabile antigens, useful for immunization, heat was not employed, but sterilized distilled water. Hoder (1932) found that "distilled water containing one part of copper in 10 million sterilized a suspension of *Ps. pyocyanea* in 2 hours".[9] The opacity of the diluted culture was compared with a suspension of barium sulphate at 0.1%.

Control of sterilization of this vaccine was effected in the following manner: during three consecutive days, four tubes of broth and four plates of nutrient agar were inoculated with one c.c.; no growth in tubes or colonies on plates were observed after incubation at 37° C. and 22° C.

Until administration of the vaccine, all other treatment had failed to ameliorate the patient's condition.

At the beginning, a minimum dose of one teaspoonful a day, for three days, was given. No bad reaction was observed. The dose was then increased to three teaspoonfuls a day. The patient felt the first effect after fifteen days. The joint pains had practically disappeared. He could make more extensive movements, and his temperature became normal. This success encouraged the preparation of a larger quantity of this vaccine following exactly the same technique with the same strain. After two months of this treatment his condition became so satisfactory that he wished to return home to the United States. Before his departure, another agglutination test with his serum and the same strain was made. His standard agglutination

rate, which was at the beginning 1/600, reached the surprising rate of 1/1,100.

When he left his condition was such that he could fulfil the activities of a man of his age. At home he continued the same treatment fifteen days per month during two other months. Three years later the patient wrote us that he had not suffered any relapse.

SUMMARY

A case of chronic infective arthritis is described. The infectious focus was in the intestine; *Ps. pyocyanea* isolated from the patient's fæces was the infective agent.

The pathogenity of this *Ps. pyocyanea* was demonstrated by inoculation in a guinea pig, and by a strongly positive agglutination test with the patient's serum.

An auto-vaccine, prepared according to special technique and administered by mouth, cured the patient. Effectiveness of the vaccine was proved by the considerably increased rate of the patient's serum agglutinins.

We wish to express thanks for the collaboration of Mr. J. M. Desranleau, Assistant Bacteriologist of the Provincial Laboratory of Bacteriology.

REFERENCES

1. BOIVIN, A. AND MESROBEANU, L.: Sur l'antigène O, endotoxine des pyocyaniques, *C.R. Soc. Biol.*, 1937, **125**: 273.
2. *Idem*: Les endotoxines bactériennes, *Presse Méd.*, 1936, **99**: 1995.
3. CAMERON, G. M.: Bacteriology of Public Health, Mosby, St. Louis, 1940, p. 127.
4. HOWITT, F. D.: The diagnosis and treatment of chronic articular rheumatism, *The Pract.*, 1939, **143**: 246.
5. NATTAN, L-LARRIER: Traité de Microbiologie, Tome II, 1934.
6. PARK, W. H. AND WILLIAMS, A. W.: Pathogenic Microorganisms, Lea & Febiger, Phila., 1939, p. 527.
7. SLUTSKY, N. AND MATLIN, P.: Pyocyaneus meningitis, *J. Am. M. Ass.*, 1939, **113**: 1400.
8. TORIKATA, R. AND SHAKUDO, M.: Experimentelle Erforschung über die Immunisierung des Darmtraktus, *Zeitsch. f. Immunitatsf*, **88**: 227. (Summary in *Bull. de l'Inst. Pasteur*, 1936, **35**: 191.
9. TOPLEY, W. AND WILSON, G. S.: The Principles of Bacteriology, Arnold, London, 1938, pp. 381, 101.

THE TREATMENT OF PERIANAL ABSCESS AND FISTULA*

BY W. F. GILLESPIE

University of Alberta, Edmonton

THE treatment of perianal abscess and fistula requires the application of fundamental surgical principles, modified by the peculiar anatomy of the part. Recent literature draws attention to several anatomical facts not commonly available in standard texts, and ignorance of them is oftentimes responsible for indecision, delay, and inefficient treatment.

SURGICAL ANATOMY

The anal canal is a passage about one and one-half inches long which develops from the union of the proctodæum with the post-allantoic gut. Its lining consists, in the upper third, of a mucosa which is puckered into the longitudinal folds of Morgagni, with the anal crypts between each pair. Below this dentate line the mucosa changes to a transitional epithelium that gradually fades into the true skin.

The longitudinal muscle of the rectum extends downward as a sheet about the canal, and its lower margin envelops the thickened extremity of the circular muscle which forms the internal sphincter. From this longitudinal muscle fibrous extensions pass down towards the skin in the manner to be described.

The anal canal, its internal sphincter, and the longitudinal muscle are surrounded by the external sphincter which is moulded about them like a ring on a finger, or like the prostate about the vesical outlet. This external sphincter consists of three parts, a fact which, although mentioned by Santorini in the eighteenth century and further described by Peter Thompson,[9] received little attention until Milligan and Morgan[8] published their valuable study of the sphincter in relation to surgery, and this has been amplified more recently by Blaisdell.[1]

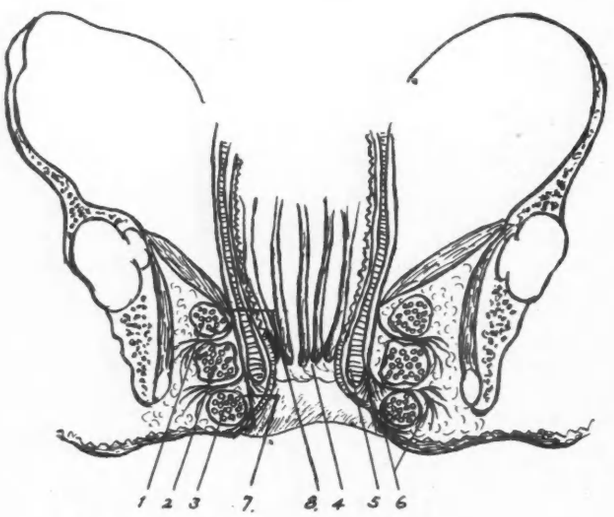
The subcutaneous portion is a thick bundle of muscle fibres forming a ring immediately under the skin, and having no prolongations anteriorly or posteriorly. It lies just distal to the internal sphincter, and is easily palpable in its whole circumference, with a groove above it, called the anal intermuscular septum, marking the separation of the muscle from the internal sphincter.

The second part, called the superficial portion, forms an ellipse as it reaches its attachments to the coccyx and the central point of the perineum. It lies above the subcutaneous portion, but is separated from the latter by fascial extensions of the longitudinal muscle. Within the grip of this muscle is the internal sphincter.

* Presented before the Canadian Medical Association in Winnipeg, June, 1941.

The third part, or deep portion, is also a circular bundle of fibres with no anterior or posterior attachments. Its lower margin is usually related closely to the superficial portion, and its upper margin fuses with the levator ani, especially the puborectalis portion of the latter.

Clinically, these structures afford us three valuable landmarks. We can palpate the subcutaneous portion; we can identify the anal intermuscular septum; and we can palpate the anorectal junction, which offers a very definite ring to the examining finger. This anorectal ring consists of the so-called internal sphincter, the longitudinal muscle, the puborectalis portion of the levator and the deep portion of the external sphincter. The puborectalis is a U-shaped muscle which acts as a sling to fix the canal to the pubic bone. The ring is seen to be much thicker posteriorly than it is anteriorly because of this muscle. Anal continence depends upon the integrity of the anorectal ring, and this structure must never be completely divided.



1. External sphincter—deep portion.
2. External sphincter—superficial portion.
3. External sphincter—subcutaneous portion.
4. Anal crypts and papillæ.
5. Internal sphincter.
6. Fascial insertions of longitudinal muscle.
7. Anal intermuscular septum.
8. Ano-rectal ring.

The drawing shows the distribution of the fascial terminations of the longitudinal muscle which reach toward the skin, particularly between the subcutaneous and deeper portions of the external sphincter, a separation perhaps reminiscent of the two layers of the sphincter cloacæ. These fascial strands may be important factors in determining the pathways taken by infections extending outwards from the anal canal.

The inferior mesenteric vessels, stretching from Alcock's canal to the anus, enter chiefly in the postero-lateral quadrants, and Hiller[6] considers that these pathways explain why the majority of fistulæ are located in these sectors. In a similar way the lymphatic drainage offers an avenue for infection. Hartmann[4] particularly stressed the importance of lymphangitis and thrombosis as a cause of perianal infection.

In addition to the structures described, attention has recently been directed to the anal ducts, those complex glandular structures first described in relation to abscess by Hermann and Desfosses.[5] They were again described by Lockhart-Mummery[7] and by Harris;[3] and Tucker and Hellwig[10] dissected 89 specimens, to show the openings of these tiny epithelial tubes into the anal crypts, and emphasized the possibility of these being pathways for the extension of anal cryptitis into the outlying tissues.

This brief anatomical review serves to show in a fresh light the anal structures, muscular, fascial, vascular, lymphatic, and glandular, which deserve consideration in the surgical problem of abscess and fistula.

ISCHIORECTAL ABSCESS

Acute perianal infection includes abscess in a hair follicle or in the blood clot of an external pile, and also processes commencing above the pelvic diaphragm through which they burrow to form pelvirectal abscesses. But the vast majority are ischiorectal abscesses, and these, almost without exception, arise from infection in anal crypts. Why the anal crypt should become infected is not understood. Ball's theory of trauma may be only one of many reasons. But, once having begun, the anatomy explains how it extends. The glandular canals which open into the crypts, the fibromuscular processes of the longitudinal muscle, and the perivascular and lymphatic spaces all offer pathways. The sequence of events, then, is (1) cryptitis; (2) extension by lymphangitis or otherwise; (3) abscess in the ischiorectal fossa. This is a relatively rigid cavity that can hold scarcely two ounces of fluid. It is bounded by the obturator fascia, the anal fascia of the levator, and the thick skin of the part. Within these rigid walls the fatty tissues resist but feebly the suppurative processes, and extension inevitably occurs; and this extension, following

the line of least resistance, passes along the original tract back to the crypt and converts a minute pathway into an actual tube. Later the skin ruptures or is incised, and so a fistula is formed. In some cases the extension travels deep to the posterior raphe to the ischiorectal fossa of the opposite side. As many as 40% of acute ischiorectal abscesses may have established gross openings into the anal canal by the time operation is undertaken.

The treatment of ischiorectal abscess, therefore, should be early operation before fistula formation. There should be no delay with fomentations and packs. We should operate even when we only suspect an abscess. Even as early as the seventeenth century Ambroise Paré advised that "the surgeon should not let them (the abscesses) ripen as in a perfect suppuration, but, following the precept of Hippocrates, should open them, the tumour being still unripe, that is to say, not entirely suppurated". Given a patient with the usual history of throbbing perianal pain, we should palpate the area about the anus with finger and thumb. A point of slight induration which is definitely tender leads us to the diseased area. A large portion of skin is removed, and the tension thus relieved. The length of the incision should be at least twice the depth of the abscess. Examination of the cavity should be made gently, to ascertain whether a fistula already exists. However, unless the pathway is quite superficial, it should not be treated further at this time. We now have a wide, shallow wound upon which we place a square of vaselined gauze. Packing must never be used. Packing is a foreign body against which the body defences have to mobilize. Occasional dressings, tub baths after bowel movements, and gentle irrigations with saline are all that is required. If we do this operation early, we can reduce the number which go on to actual fistula.

ANORECTAL FISTULA

Every fistula is a shrunken abscess. Now there is a long, narrow, perhaps tortuous, infected tube which Nature has localized but cannot overcome. Perhaps some 10 or 15% are tuberculous, but the explanation for the persistence is to be found in the ordinary causes of any sinus, continued infection, inefficient drainage and incomplete rest.

The treatment of such a channel, anywhere on the body surface, is "saucerization". In chronic osteomyelitis we do not hesitate to convert a sinus into a shallow trough by the wide sacrifice of its margins. This is precisely the treatment for fistula. However, the integrity of the sphincter raises an anatomical problem, the solution of which depends upon establishing the relationship of the tract to the anal musculature.

The primary opening is to be found in an anal crypt, and experience shows that the majority are to be found close to the posterior commissure. Goodsall's[2] rule is worth repeating. If the skin opening is found to be anterior to the transverse diameter of the anus and within two inches of the anal verge, the fistula will be found to pass in radially, whereas openings posterior to this line communicate with the lumen close to the posterior commissure.

The first problem is to find the main course of the fistula. Palpation furnishes much assistance, for, with the forefinger within the canal and the thumb pressing about the orifice, a firm, cord-like mass may be felt, and this represents the scarred track of the fistula. Then with an anoscope in position a hooked probe explores the various crypts in the involved sector. If this proves unsatisfactory a flexible probe may be gently passed from the secondary, or skin, opening, and made to present through the primary opening in the crypt. Rarely the injection of dyes and even radio-opaque solutions need to be employed.

We must now decide whether the channel passes superficially to the subcutaneous portion of the external sphincter, just deep to it, or through deeper muscle planes. We recall that the upper margin of the subcutaneous portion of the external sphincter is easily palpated, as also the anal intermuscular septum which separates the muscle from the internal sphincter and the anorectal ring. Fistulæ may be classified conveniently into three main groups: (1) Subcutaneous or submucous (about 36%). (2) Anal fistulæ—those opening into the canal below the anorectal ring. Milligan and Morgan[8] subdivide this group into (*a*) low level — those passing between the subcutaneous portion of the external sphincter and the internal sphincter (about 50%); (*b*) high level — those passing through the superficial or deep portions of the external sphincter. (3) Anorectal fistulæ — which extend above the anorectal ring, no matter where the primary opening is found.

About 85% of fistulæ fortunately belong to the first two groups.

The treatment of fistula is incision. It requires the saucerization of the whole tract, including all the lateral offshoots, which must be carefully traced. Perhaps occasionally a superficial one may be excised and its bed sutured, but the vast majority are best dealt with by converting the fibrous tube into a wide, shallow wound which will heal from the bottom. The closing of chronic infected wounds is rarely successful.

The main tract is mapped out by a probe or grooved director and its relations to the anal musculature determined by palpation. If the anorectal ring is not involved, the probe is boldly cut down upon, converting the tube into a trough. This trough is now widened by cutting off its edges as well as by extending the incision radially. Radical sacrifice of tissue is necessary, because what appears as a wide, shallow wound while the patient is in the lithotomy position becomes narrower and deeper when the thighs are brought together. In cutting the muscle care must be taken to cut cleanly, and radially to the fibres. A third of the cases will be subcutaneous, but the majority will require sacrifice of the subcutaneous portion of the sphincter. Only a few will pass through the deeper portions of the external sphincter.

If there is difficulty in determining the exact relation of the tract to the musculature, it is wiser to do a two-stage operation. At the first, saucerization is carried down to the muscle and a stout ligature of silk is loosely tied through the tract and about the muscle fibres. By the end of a fortnight the scar which has formed will prevent too wide separation of the muscle when it is now divided. This procedure prolongs the disability but little and adds to the safety. The more experienced the surgeon, the less often has he to resort to the two-stage procedure, but, as Lockhart-Mummery[7] says, it is easier to do a two-stage operation than to do a one-stage operation and then deal with incontinence. The anorectal ring must never be divided under any circumstance. The operation is now completed by searching for and boldly dividing the secondary lateral tracts so that none of the ramifications remains tubular.

The postoperative care is simple but exacting. The wide wound is dressed with vaselined gauze, gently spread over its surface. It must never be packed, for packing merely offers an additional insult to soft and vulnerable fatty and muscular tissue which already has to deal with infection and operative trauma. Dressings are done daily until the wound is covered with healthy granulations which Mont Reid calls a benign new growth. The bowels are allowed to move by the third day, and the patient is put on a full diet which will provide a formed movement. After defæcation the wound is gently but thoroughly irrigated with saline. After a few days the patient is encouraged to go to the toilet and then to sit in warm bathwater for a few minutes before a fresh dressing is applied. After the fifth day the surgeon passes a well vaselined finger into the anal canal daily. This smooths out the folds and prevents "bridging", which would spell failure. Within two weeks or so the field is a clean, superficial granulating wound that is practically painless. The patient now becomes ambulant, but still requires daily inspection by the surgeon who is on the look out for missed lateral tracts. These can now be recognized as pearly gray snail-like patches in the healthy red granulations. Such areas must be freely opened up at once.

Our failures will likely be due to one of three causes. The internal opening has not been opened; or lateral offshoots have not been recognized; or, too conservative an operation has permitted bridging. We can avoid incontinence, firstly, by protecting the anorectal muscular ring; secondly, by dividing the sphincter only once and never obliquely; thirdly, by avoiding packing.

Tuberculous infection occurs in approximately 10 to 15% of fistulæ. This number varies with the thoroughness of the laboratory study. Clinically it raises the problem of surgical tuberculosis of any surface. If the general condition of the patient is satisfactory the local lesion can be dealt with radically. If the general condition is unsatisfactory the surgeon must approach the local lesion with the utmost caution and conservatism.

SUMMARY

1. Ischiorectal abscess always arises from cryptitis.

2. Ischiorectal abscess will produce a fistula if opening is delayed.

3. Fistula represents a shrunken abscess.

4. Treatment necessitates saucerization throughout all tracts.

5. This procedure requires a thorough appreciation of the anal structures as here reviewed.
6. Packing is contraindicated.

REFERENCES

1. BLAISDELL, P. C.: *Surg., Gyn. & Obst.*, 1937, **65**: 672.
2. GOODSALL, D. H. AND MILES, W. E.: Diseases of the Rectum, Part 1, Longmans Green & Co., London, 1904, p. 98.
3. HARRIS, H. A.: *Proc. Royal Soc. Med.*, 1929, **22**: Part 2, 1341.
4. HARTMANN, H.: Chirurgie du Rectum, Masson et cie, Paris, 1931, p. 41.
5. HERMANN, G. J. AND DESFOSSES, L.: *Compt. Rend. Acad. des Sc.*, 1880, **90**: 130.
6. HILLIER, R. I.: *Surg., Gyn. & Obst.*, 1931, **52**: 921.
7. LOCKHART-MUMMERY, J. P.: *Proc. Royal Soc. Med.*, 1929, **22**:, Part 2, 1331.
8. MILLIGAN, E. T. C. AND MORGAN, C. N.: *The Lancet*, 1934, **227**: 2: 1150 and 1213.
9. THOMPSON, P.: The Myology of the Pelvic Floor, Newton, McCorquodale & Co., 1899.
10. TUCKER, C. C. AND HELLWIG, C. A.: *Surg., Gyn. & Obst.*, 1934, **58**: 145.

CHRONIC IDIOPATHIC HYPOPARATHYROIDISM*

BY M. M. CANTOR AND J. W. SCOTT

Edmonton

HYPOPARATHYROIDISM is a disease due to partial or total abolition of parathyroid function. It arises usually as a complication of thyroidectomy from the accidental removal of one or more of the parathyroid glands during the operation. Occasionally it occurs when too great an amount of hyperactive parathyroid tissue is removed in the treatment of osteitis fibrosa cystica. On very rare occasions it is seen in persons in whom no such operative procedures have ever been performed. In these cases the only evidence of hypoparathyroidism is that of increased neuro-muscular irritability associated with a disturbance in calcium and phosphorus metabolism. Since the etiology in these cases is obscure or uncertain, they are designated as instances of idiopathic hypoparathyroidism. The rarity of proved instances of the disease warrants this report of a single case.

CASE REPORT

F.B., a Danish labourer, aged 44 years, was admitted to the University of Alberta Hospital on February 14, 1942.

He complained of generalized weakness and muscle cramps His illness began five years before with attacks of numbness in the hands and feet. The muscles of the hands and fingers would tighten and "draw up". The hands would go into spasm and the finger tips would approximate each other. The feet and toes turned down. The facial muscles felt tight and began to twitch. These attacks lasted up to thirty minutes, and would occur several times a day. They rarely occurred at night. He found that exercise often brought on an attack. He has become progressively weaker over the past five years and has been unable to work.

Past history and family history were negative.

Enquiry revealed that he had had a loss of sexual desire and sexual power for ten years. His hair had been falling out for a few years. For the past year his eyesight had been failing.

Objective investigation showed good nutrition and normal intelligence. The hair was dry and sparse and the skin dry. No abnormality was noted in the neck. Chvostek's and Trousseau's signs were present. The deep reflexes were hyperactive.

Dr. M. R. Levey, of the Department of Ophthalmology, reported early central opacity of the post-cortical layer of each lens.

Laboratory investigation showed urinalysis, blood count and stools to be normal. The Wassermann reaction on the blood and cerebrospinal fluid was negative. The blood non-protein nitrogen was 40 mgm. %, and the basal metabolism rate −33. The serum calcium was 5.3 mgm. %; serum inorganic phosphorus 2.2 mgm. %; and the blood plasma phosphatase 5.4 Kay units. The cerebrospinal fluid calcium was 5.5 mgm. %; and the inorganic phosphorus 1.6 mgm. %. The carbon dioxide combining power of the plasma was 56 vols. %.

An x-ray examination of the soft tissues of the neck showed several minute areas of calcification. There was x-ray evidence of slight osteoporosis of the lower ends of both fibulæ.

This patient had previously been under the care of Dr. M. Dolgoy in the Royal Alexandra Hospital in April, 1941. Investigation at that time showed evidence of latent tetany. In addition, however, the patient had a history of an acute confusional psychosis of several weeks' duration from which he made a good recovery. The laboratory findings were similar to those reported above. Renal function tests at that time, as on the present admission, showed no evidence of derangement. The excretion of calcium in the urine was very low.

DISCUSSION

Drake *et al.*[1] set out the criteria which must be met before a diagnosis of chronic idiopathic hypoparathyroidism may be made. The serum should show a decrease in calcium and an increase in inorganic phosphorus. There should be no evidence of renal insufficiency and no radiographic indication of rickets or osteomalacia. The signs and symptoms of tetany should be present. Cataracts, trophic nail changes and other ectodermal changes may occur. To these we might add that the history should show no gross gastro-intestinal disorders associated with prolonged diarrhœa, should not contain evidence of prolonged septic processes, and should be free of implication in a dietary deficiency of calcium and vitamin D.

Our patient fulfils all but two of these criteria. The serum inorganic phosphorus was

* From the Departments of Biochemistry and Medicine, University of Alberta, Edmonton.

never increased and there was radiographic evidence of moderate osteoporosis in the fibulæ. He showed in addition, during his first admission, the acute confusional psychosis described by Snapper.[2]

The osteoporotic change noted was of such a slight degree as would ordinarily remain unnoticed and may for all purposes be disregarded. As for the absence of an increase in the serum inorganic phosphorus, we agree with Shelling[3] that the demonstration of hyperphosphatæmia is not essential to the diagnosis. In our patient, the serum calcium varied between 3.2 mgm. and 6.8 mgm. % (normal 9 to 11 mgm.). The phosphorus varied in the same period between 2.2 mgm. and 3.5 mgm % (normal 2 to 4 mgm.). It seems reasonable to argue that when the inorganic phosphorus is at a normal level in the presence of a very low calcium, the ratio of calcium to phosphorus is altered precisely in the same manner as it would be if the phosphorus were increased and the calcium only moderately reduced. The imbalance produced by such a "relative" preponderance in phosphorus would be similar to that produced by an "absolute" increase. In this regard it seems pertinent to recall that under certain conditions tetany may occur when the serum calcium is normal or it may not occur when the serum calcium is low.

It is beyond the scope of this paper to enter into a detailed discussion of the physicochemical state of calcium phosphate in the blood and in the cerebrospinal fluid. Cameron and Moorehouse[4] in parathyroidectomized dogs and Nourse *et al.*[5] in infants with tetany were unable to detect changes from normal in spinal fluid calcium. Their results were in disagreement with those of Critchley and O'Flynn,[6] who showed definite decreases during tetany in infants and increases to normal during treatment.

In our patient, when the serum calcium was 5.2 mgm. % and the phosphorus 2.2 mgm. % the spinal fluid showed a calcium level of 5.5 mgm. % and the phosphorus 1.2 mgm. %, both values normal. At this time the patient was not in tetany. We are conscious of the fact that the spinal fluid calcium does not all represent calcium in "ionic" form. However, since tetany did not occur in the face of such gross serum calcium-phosphorus imbalance it seems reasonable to suggest, as does Wiggers,[7] that it is not the total amount of calcium but the quantity of "ionized" calcium that determines an attack in these cases.

Slight alterations in the hydrogen-ion concentration of the blood such as those produced by violent exercise with an increase in CO_3'' or by dietary indiscretions with an increase in PO_4''' might easily reduce the level of "ionic" calcium and increase the tendency to spasmophilia. Such indeed is the history of events in our case as well as in some others reported.[1]

The minute areas of calcification in the soft tissues of the neck remain unexplained. It seems futile to enter into a discussion of their probable nature, in the absence of any biopsy material.

SUMMARY

A case of chronic idiopathic hypoparathyroid tetany is presented. The criteria on which the diagnosis is based are reviewed and amended. It is suggested that an elevation in the serum inorganic phosphorus is not essential to the diagnosis, but that the level must be increased "relatively" to the serum calcium. That the cerebrospinal fluid calcium and phosphorus remain unaltered in the presence of hypocalcæmia is confirmed.

Our thanks are due to Dr. M. Dolgoy who referred this patient.

REFERENCES

1. DRAKE, T. G., ALBRIGHT, F., BAUER, W. AND CASTLEMAN, B.: *Ann. Int. Med.*, 1939, **12**: 1751.
2. SNAPPER, I.: *Arch. Int. Med.*, 1930, **46**: 506.
3. SHELLING, D. H.: The Parathyroids in Health and Disease, Mosby, St. Louis, 1935, p. 123.
4. CAMERON, A. T. AND MOOREHOUSE, V. H. K.: *J. Biol. Chem.*, 1925, **63**: 687.
5. NOURSE, J. D., SMITH, D. N. AND HARTMAN, J. I.: *Am. J. Dis. Child.*, 1925, **30**: 210.
6. CRITCHLEY, M. AND O'FLYNN, E.: *Brain*, 1924, **47**: 337.
7. WIGGERS, C. J.: Physiology in Health and Disease, 2nd Ed., Lea & Febiger, Philadelphia, p. 1026.

THE DISTRIBUTION OF THROMBI IN VEINS OF THE PELVIS AND LEGS IN RELATION TO THE POSSIBLE VALUE OF LIGATION OF THE FEMORAL VEIN*

BY E. S. INGRAHAM, JR., M.D.

Montreal

THIS report represents a preliminary study of the advisability of ligating the femoral vein above its junction with the saphenous as a prophylactic measure against pulmonary embolism, when a diagnosis of thrombosis of the leg veins is established. Such a diagnosis has been shown by Culp[2] to be probable in the presence of increasing circumference of the legs as judged by repeated measurements at numerous regular levels; a slight elevation of temperature and local pain are additional but inconstant signs. Ligation of the femoral vein, with evacuation of the vein if necessary, has been suggested to prevent fatal pulmonary embolism in the presence of such signs, or after a non-fatal pulmonary embolus. The sites advocated for ligation are the sapheno-femoral junction, or the femoral vein just distal to the entrance of the profunda femoris vein.[3]

In order to study the sites of formation of the thrombi which give rise to pulmonary embolism, particularly with reference to the sapheno-femoral junction, exploration of the vena cava, iliac veins, veins of the pelvis, and the femoral veins, at least to the sapheno-femoral junction, was made with particular care in routine post-mortem examinations of adult cases for the period of this study.

Thrombosis. — In 246 unselected cases examined, 28 (11.4%) were found to have thrombi in one or more of the veins mentioned above. The distribution of the thrombi by cases was as follows:

Veins proximal to the femoral	5	
Femoral and proximal veins	10	
Prostatic (2), pelvic (1), perirectal (1), and veins at site of rt. herniorraphy (1)	5	
	—	20
Femoral vein alone	2	
Femoral and distal veins	4	
Loose thrombi, exact source unknown	2	8
	—	—
		28

In the latter group of 8 cases only, or in about one-quarter of the total in which thrombosis was found, would ligation of the sapheno-femoral junction or evacuation of the vein from that site have been expected to protect against embolism. However, of the 23 cases in which the thrombosis was in veins draining the *legs,* 8 would have been protected and 15 not benefited.

The thrombi in this series were as frequent on the right as on the left side of the body, in contrast to the traditional view that compression of the left common iliac vein by the right common iliac artery makes thrombosis more common on the left. Medical cases were as frequent as surgical cases in this group, though Belt[1] and Hunter[4] have both reported large series in which medical cases predominated. This high incidence of thrombosis in medical cases is a fact ignored in many discussions of the subject and not assimilated into common medical knowledge. As in the series of Belt and Hunter, the medical patients in this series were largely those suffering from cardiac decompensation or chronic debilitating disease.

Thrombi were found most frequently in the common and external iliac veins. They often extended into the femoral region, but the thrombi usually appeared older in the more proximal vessels, with a gradation into obviously post-mortem clot in the region of the entrance of the great saphenous or profunda veins.

Thrombosis was visible extending deep into the leg from the femoral in only 5 instances, in 1 of which thrombosis extended proximally into the iliacs. In 2 instances, the saphenous vein was thrombosed and in 2 the femoral and popliteal veins. The veins deeper in the leg were not explored in this study but in 2 cases loose thrombi of small diameter were found in the iliac veins and presumably these thrombi had their origin in the deeper leg veins.

The veins of the calf, ankle and foot have been shown by Rössle,[6] Newman,[5] and Hunter[4] to be frequently the seat of thrombosis. Dissections of the venous plexuses among the calf muscles, the origin of the posterior tibial vein, and the plantar venous loop, showed thrombosis in one or more of these sites in one-quarter to one-half of the cases examined by these authors.

* From the Department of Pathology, McGill University, Montreal, Canada.

These thrombi, however, seldom gave origin to fatal pulmonary emboli, though smaller emboli were common.

Prior to the commencement of this study two cases, not included in the present series, were observed in which thrombosis was traced directly to phlebotomy incisions on the ankles, bilateral in one case.

EMBOLISM

The incidence of embolism of the pulmonary arteries in routine autopsied cases has been repeatedly shown to be over 10%,[1, 4] and though the proportion of fatal to non-fatal emboli is small, many non-fatal emboli are of sufficient size to affect significantly the patient's clinical course. This is particularly true in the cases in which passive hyperæmia of the lungs predisposes to the formation of pulmonary infarcts.

Pulmonary emboli, thrombi or infarcts were present in 32 (13%) of the 246 cases studied. In 18 a source of embolus was identified in the pelvic or leg veins, and in 3 in the right auricle. Of the remaining 11 cases, in which no source of embolus was identified, one patient died of actinomycosis and had thrombosis of the main artery to the lower lobe of the right lung without infarction; 8 died of some form of heart disease with circulatory failure, 1 of resolving bronchopneumonia. One, a case of fracture of the neck fatal four days after the injury, showed multiple small pulmonary "emboli" without infarction. Expert, critical examination *in situ* of these thrombi in the pulmonary arteries was not made in all instances, but in 5 cases the word "embolus" was used, in 2 "thrombus", and in 4 there were infarcts in association with which no thrombosis was identified. Bearing in mind the high incidence of peripheral vein thrombosis in cases of cardiac decompensation[1, 4] these figures tend to support the contention that the great majority of instances of thrombotic occlusion of the pulmonary arteries is the result of embolic occlusion rather than of autochthonous thrombosis.

If, in order to favour the idea of prophylactic ligation of the femoral vein as much as possible, the 28 cases in which thrombi in the peripheral veins were found are added to the eleven cases with pulmonary lesions in which no origin for emboli was found, the total of 39 cases represents the maximum number in which there was reason to suspect a danger from embolism. In 20 of these cases or one-half of the total, the thrombosis was located, or extended, central to the sapheno-femoral junction and was therefore not capable of being isolated by ligation of the vein. In only 6 of the remaining 19 cases was there thrombosis of the femoral veins, the only site distal to the proposed site of ligation from which large emboli could be expected to arise. The possible presence of thrombi in the deeper veins in most of the other 13 cases is unproven and problematical and the emboli, if the embolic nature of the pulmonary arterial occlusions is conceded, were uniformly of but slight importance. It is significant that in these 13 instances the presumed thrombosis would necessarily be located in the small veins of the legs from which fatal embolism is unusual and in which a clinical diagnosis of thrombosis is most difficult. On the other hand, of the 26 instances in which the thrombosis was located in a dangerous site, and in the site in which thrombosis produces diagnostic signs, 20 were proximal to the suggested site of ligation.

HISTOLOGICAL STUDIES

Histological sections were made of the femoral veins at the level of the sapheno-femoral junction, or of the veins involved by thrombosis, or both, in 29 cases. These included 23 of the cases in which thrombosis of the peripheral veins was found.

The veins not the seat of thrombosis showed but little alteration from normal, with one exception. There was frequently irregular fibrous and fibromuscular thickening of the intima and considerable variation in the thickness of the muscular coats; in addition there were variations in the proportion of connective tissue and muscle in the wall and in the consistency of the connective tissue component. In the one case in which marked abnormalities were present, one femoral vein showed phlebitis consisting of œdema, lymphocytic infiltration and proliferation of capillary endothelium in the outer half of the wall. Nevertheless, there was no thrombosis.

The walls of the veins involved by thrombosis showed œdema, hyperæmia, infiltration of leucocytes, degeneration of smooth muscle fibres and proliferation of fibroblasts and capillary endothelium in small or large segments of their circumference. Such changes were most frequent in the inner circular muscle bundles and were absent from the veins not the seat of thrombosis. These changes have previously been

interpreted as being secondary to thrombosis rather than its cause,[4] and no evidence to contravert that opinion was found in these sections.

SUMMARY AND CONCLUSIONS

Study of 246 unselected autopsied cases showed thrombosis of veins of the pelvis or legs in 28 instances (11.4%). Examination of the distribution of these thrombi in respect to the possible prophylactic value of ligation of the femoral vein in the region of the saphenofemoral junction showed that when a thrombus was present in the femoral vein it was twice as likely to extend proximally beyond the inguinal ligament as to be localized in the femoral, or to extend into the deeper leg veins. The diagnosis of thrombosis in the deeper leg veins is uncertain and ligation of the sapheno-femoral junction in such cases would protect chiefly against small, rarely fatal emboli.

It is concluded that ligation of the saphenofemoral junction is impractical as a prophylactic measure against pulmonary embolism in cases in which the clinical diagnosis of thrombosis of the leg veins can be established, because of the extension of the thrombus proximal to the sapheno-femoral junction in the majority of instances. In cases of thrombosis of the deep leg veins in which ligation at the suggested level would be effective, the clinical diagnosis of thrombosis is difficult and the signs inconstant; in addition, the danger to the life of the patient from emboli originating in these deeper veins is small.

REFERENCES

1. BELT, T. H.: Autopsy incidence of pulmonary embolism, *The Lancet*, 1939, 1: 1259.
   Idem: Thrombosis and pulmonary embolism, *Am. J. Path.*, 1934, 10: 129.
2. CULP, O. S.: Postoperative venous thrombosis and pulmonary embolism: analysis of eighty-eight cases, *Johns Hopkins Hosp. Bull.*, 1940, 67: 1.
3. HOMANS, J.: Venous thrombosis in the lower limbs, its relation to pulmonary embolism, *Am. J. Surg.*, 1937, 38: 316.
4. HUNTER, W. C.: The incidence, etiology and fate of thrombosis of the deep leg veins in 351 unselected autopsies, *Am. J. Path.*, 1940, 16: 696.
5. NEWMAN, R.: The site of origin and mode of development of thrombosis in the leg veins, *Virchow's Arch.*, 1938, 301: 708.
6. RÖSSLE, R.: The significance and pathogenesis of thrombosis of the veins of the leg, *Virchow's Arch.*, 1937, 300: 180.

OXYGEN THERAPY AND RESUSCITATION*

BY M. DIGBY LEIGH AND FRANCES M. RICHARDSON

Montreal

Oxygen therapy.—It has taken many years for oxygen therapy to gain its rightful recognition as a worthwhile therapeutic measure. This was owing largely to the improper and dilatory methods of administration, which left the physician somewhat skeptical as to the beneficial effects. A few physicians, mindful that such a sound physiological principle as oxygen requirement should not be ignored, persevered and developed the maxim that anoxia should be corrected early, before irreparable damage occurred. If this was not done, other later therapeutic measures would be practically useless.

Since the supply of oxygen is vital, it is good practice to be mindful of the transportation of oxygen from the atmosphere to the tissues. This supply to the tissues can fail under any of the following circumstances: (*a*) Low tension of oxygen in the atmosphere breathed, as occurs in aviation or anæsthesia. (*b*) Inefficient pulmonary ventilation, as occurs in obstruction to airway, pneumonia, atelectasis, pulmonary fibrosis, pulmonary œdema, paralysis of the muscles of respiration or convulsions. (*c*) Inefficient circulation carrying the oxygen from the pulmonary capillaries to the tissues, as occurs in anæmia, carbon monoxide poisoning, shock or spinal anæsthesia. (*d*) Impaired function of the cells preventing utilization of the oxygen brought to them, as occurs in cyanide poisoning, and certain narcotics, such as chloroform and ether. From this concept of oxygen transportation, the physician can often predict which cases may require assistance in maintaining their oxygen requirement. If this transportation of oxygen from the atmosphere to the tissues is abruptly and completely stopped, then it is only a matter of minutes before the entire transportation system is brought to a stop. In

* Read at the Seventy-third Annual Meeting of the Canadian Medical Association, Jasper Park, Alberta, June, 1942.

From the Department of Anæsthesia, Children's Memorial Hospital.

the more prolonged instances, which are by far the more common, the continued anoxia upsets the normal physiology of the body, and this, too, is a threat to the life of the individual.

That anoxia does disturb the body is evident by the following. Warnock and Tovell draw attention to the nervous system effects of headache, visual disturbances, irrational states, delirium, and hyperpyrexia. Courville examined the brains of patients who had died from anoxia under nitrous oxide anæsthesia. He illustrated changes varying from sclerosis of scattered pyramidal cells in the least damaged, to subtotal destruction of the cortex in the most damaged.

White, Verlot, Selverstone and Beecher noted that anoxia results in an increase in the intercellular and intracellular fluid of the brain. This accounts for the difficulties encountered during intracranial operations if there is obstruction to respiration. Krogh observed increases in the size and permeability of the capillaries. There was also a decreased blood volume and an increased blood concentration. These effects became irreversible after 15 minutes of anoxia. Hilton and Eicholtz reported that in incipient anoxia there was dilatation of the coronaries with a transient rise in the cardiac output and an increase in the pulse rate.

Van Liere, Crisler and Robinson detected a prolongation in the emptying time of the stomach. Van Liere and Crisler found that the contractions of the stomach were reduced. Crisler and Van Liere also noted that the gastrointestinal secretions were slightly modified. Wiggers reported that the urinary output was lowered by moderate anoxia and that prolonged anoxia produced anuria. Van Liere, however, summarizing the work of other investigators, says that it takes a marked anoxia to affect the kidneys. Kellaway noted a rise in blood sugar during anoxia.

It is unfortunate that such marked physiological changes do not manifest themselves with obvious signs and symptoms; because of this apparently symptomless period, damaging anoxia may exist for some hours before remedial oxygen therapy is commenced. Lives will be saved if treatment is early and delay avoided by keeping in mind which patients are likely to fail in the maintenance of their oxygen requirement. They are obviously those in which the links in the transportation system carrying oxygen from the atmosphere to the tissues are defective; to repeat, these defects are: Low tension of oxygen in the atmosphere breathed, defective pulmonary ventilation, inefficient circulation, and inefficient utilization of the oxygen by the cells, due to the presence of drugs in the body. If oxygen therapy is not started as soon as the defects in oxygen transportation system are observed, then the anoxia will probably increase and more definite signs and symptoms of anoxia will make their appearance before the damage has become permanent.

Tovell and Remlinger state that in slight anoxia there are hypernœa and rapid pulse, in moderate anoxia there are headache, nausea and vomiting, and in acute anoxia there are delirium, fever and coma. If, however, there is a slow onset of anoxia, there will be exhilaration, emotional disturbances, amnesia and ataxia. Cullen and Skewis add to the symptoms of this gradual onset of anoxia, sighing, restlessness, yawning, and precordial pain. From Barach, who has had considerable experience with chronic cardiac and respiratory disease, we get as additional pointers to anoxia, rapid pulse out of proportion to the fever, presence of a grayish colour, rapid shallow breathing and irrationality. Waters, who has had considerable experience as an anæsthetist, and, as such, has had the opportunity of seeing acute extreme oxygen want, lists the signs and symptoms as slow bounding pulse which may be irregular, dilated fixed pupils, depressed or arrested respiration, raised blood pressure until respiratory arrest, convulsive muscle movements and cyanosis or ashen colour. It should be borne in mind that the presence of cyanosis should not be ignored. In anæmia, carbon monoxide poisoning, poliomyelitis, and in spinal anæsthesia cyanosis is a late sign. According to Barach, in patients with severe anæmia cyanosis may not be demonstrable, even when the oxygen tension of the blood is lowered 30 or 40%. Stadie points out that oxygen blood saturation is 10 to 15% below normal before cyanosis is perceptible.

It must be, therefore, that the signs and symptoms of anoxia vary under different conditions. These signs and symptoms, although due to interference with the oxygen transportation system, can be relieved by increasing the oxygen in the inspired air; namely, by oxygen therapy. This increases the amount of oxygen in the blood. Boothby says that inhalation of

100% oxygen increases the amount of oxygen carried by 100 c.c. of blood from 20 to between 22 and 23 c.c. Campbell and Poulton state that when circulation is slowed, then 100% oxygen inhaled increases the oxygen tension in the tissue spaces 50 to 75%. It is little wonder that during the past few years oxygen therapy has been reported useful in many diseases. It has reached the same point as has fluid therapy. Fluid therapy attempts to maintain a normal salt and fluid balance of the body; oxygen therapy attempts to maintain at least a normal oxygen supply to the body.

In most instances the cause of the anoxia is an impairment to some phase or phases of the oxygen transportation system. Oxygen therapy has been reported useful under the following circumstances: in anæsthesia, aviation or mountain climbing there may be a marked reduction in the oxygen tension of the inspired air. In obstruction to the respiratory air passages, or in reduction of the pulmonary ventilating area, as in pneumonia or pulmonary œdema, or in the paresis or paralysis of the muscles of respiration oxygen has been considered to be valuable by Barach, Evans and Durshordwe. Binger, before the days of the sulfonamides, reported a definite correlation between anoxæmia and mortality in pneumonia. Similarly in pulmonary embolism, De Takats and Jesser have found 100% oxygen therapy useful in improving the cyanosis and dyspnœa. Drugs such as morphine may result in a serious want of oxygen according to Davis, even though some sedatives decrease the oxygen consumption, according to Jowett and Quastel. McFarland and Barach found that in alcoholic intoxication oxygen therapy will make the patient more co-operative. In cases of respiratory obstruction, such as asthma, Barach and Visscher have recommended helium and oxygen, since this mixture can be breathed through narrow orifices at a pressure approximately one-half that required for movement of air or pure oxygen. In some patients requiring oxygen therapy the circulatory part of the oxygen transport system is at fault. Means, Newburgh and Lundsgaard observed a diminished oxygen saturation in the venous blood in cases of cardiac insufficiency. Harrop noticed a reduction in the oxygen content of the arterial blood in patients with cardiac disease. Campbell and Poulton found that in cases of cardiac insufficiency treated with oxygen there was decreased pulmonary ventilation and increased carbon dioxide in the expired air. Barach and Richards noted that oxygen therapy in cardiac failure caused increased arterial oxygen saturation with decrease of cyanosis and cough, diminished pulmonary ventilation, and lowered pulse rate. Subjectively, there was relief from dyspnœa and orthopnœa. Some patients experienced marked diuresis and a disappearance of œdema.

Lewis believes that the pain of coronary thrombosis and angina pectoris is due to ischæmia of the cardiac muscle. This view is supported by Rothschild and Kissin, who induced anginal pain by lowering the concentration of oxygen breathed by patients with coronary arteriosclerosis. Levy, Patterson, Clark and Bruenn developed the anoxæmic test as an index of coronary reserve. They had patients breathe a 10% oxygen atmosphere for 20 minutes, then observed the electrocardiogram and the onset of precordial pain. Rizer, Levy, Barach, Bruenn and Boland reported the relief of pain and subjective symptoms following 100% oxygen administration. Interruption of treatment causes recurrence of symptoms. Many patients with anæmia from hæmorrhage can be saved by the immediate use of oxygen together with the other restorative measures. This is especially true in the operating room. It is also true in carbon monoxide poisoning, where there is a reduction of available hæmoglobin, according to Drinker, who states that the affinity of carbon monoxide for hæmoglobin is about 210 times as great as that of oxygen for hæmoglobin. In treating these Sayers and Yant recommend pure oxygen in the mild cases, since this prevents the after-collapse. Drinker and Shaughnessy suggest the use of 7% carbon dioxide and 93% oxygen. In some instances both respiration and circulation are depressed.

In spinal anæsthesia, Schuberth's experiments showed that in man there is decreased cardiac output and increased arterial-venous oxygen difference. For this reason it is good practice, according to Burford and Leigh, to give oxygen during spinal anæsthesia, so that almost complete oxygen saturation of the arterial blood is maintained. Similarly, Snyder noted that the average cardiac output in the period of recovery from ether was decreased by 41% of the pre-operative level. Return to normal required one to four days. Systolic blood pressure in this series dropped 31 mm.

of mercury. In addition, there is invariably a depression of respiration. Barach, Richards and Parsons, Boothby, Mayo and Lovelace recommended oxygen therapy for a few hours post-operatively in the more severe cases. Aub and Cunningham found a marked reduction in oxygen content of venous blood in the early stages of shock before blood pressure had begun to fall. Schnedorf, Munslow, Crawford and McClure found a decreased blood oxygen following head injuries. They suggested oxygen therapy in these cases.

Simpson pointed out that oxygen consumption increases 5.5% for each degree of rise in temperature, giving a 40% rise for a temperature of 106°. Hartmann, Cullen, Weir and Cook, therefore, recommended oxygen for fever therapy. In thyroid disease where there is an increased demand for oxygen, Haines, Boothby, Cullen and Skewis recommended oxygen. Schwab, Fine and Mixter have used 95% oxygen inhalations to reduce postencephalographic symptoms, especially the headache.

McIver, Redfield and Benedict showed that nitrogen was absorbed rapidly from the intestine when oxygen was given. Fine, Frehling and Starr confirmed this work and clinically Fine, Hermanson and Frehling used 95% oxygen in post-operative intestinal distension and reduced the distension by 60 to 70% in 24 hours. Paine, Lynn and Keys showed by keeping dogs in 95 to 100% oxygen that after 24 hours the concentration of oxygen in the lumen of the obstructed intestine began to decline. An oxygen concentration over 75% caused pathological changes in the lungs, liver, spleen and kidneys. These changes did not occur if the oxygen administration was interrupted. Nicodemus used oxygen therapy in eclampsia and felt that it improved the bluish discoloration of the skin and the restlessness.

It is little wonder, after consideration of all these findings, that so many diseases have been benefited by oxygen, since many diseases affect the efficiency of the oxygen transportation systems, which are respiration and circulation. Oxygen therapy is merely an effort to maintain the normal physiological allowance of oxygen so that normal defensive mechanisms or drug therapy may do their work in an organism which already has not been acutely damaged by anoxia.

Oxygen therapy, given early, saves many lives and shortens the convalescence period, and, therefore, is used more widely. Consequently its increased use has added to the cost, so that some institutions have found it cheaper to pipe that oxygen into the rooms from a reservoir of oxygen located outside of the hospital. Buerki has described the plan which is in use at the Wisconsin General Hospital. The National Fire Protection Association has given a description for the construction and installation of piping systems for the distribution of oxygen. The American Medical Association has published a brief review of the methods of administering oxygen, and this article should be consulted by the physician using oxygen therapy for the first time. The following statement, taken from their pamphlet, should make the physicians who use oxygen therapy examine their own methods carefully: "Oxygen therapy is frequently administered in a wasteful and ineffective manner, not only in private practice, but also in the wards of hospitals."

The following is a review of the various methods which have been suggested for giving oxygen, the efficiency of each depending upon attention to details. Barach and McCarthy have described the chamber method, in which the atmosphere of a specially constructed room is kept at a high concentration of oxygen, up to about 45%. The method is the most comfortable, but the cost is high. In such a chamber the temperature is maintained at 64 to 66°, humidity 35 to 40%.

The next is the tent method; the details of this have been outlined by the American Medical Association. Its advantages are, according to Poulton and Adams, that a high concentration of oxygen can be obtained, the atmosphere is cooled, and there are no uncomfortable appliances on the face. Its disadvantages are its high initial cost, interference with nursing, claustrophobia, and the necessity for close supervision, especially for oxygen and carbon dioxide concentration, and humidity. Perhaps no method has been so inefficiently used. Warnock and Tovell reported in testing the oxygen concentration in a number of tents, picked at random, that it averaged 23 to 28%. If the tent method is employed, there are certain conditions on which insistence must be put. The oxygen concentration should be tested two or three times a day, but not immediately after filling. The required concentration of oxygen depends, of course, upon the degree of anoxia. Temperature should range between 58 and 68° F., and

for infants it should be higher; relative humidity should be from 40 to 60%. Carbon dioxide should not be above 1.2%. These conditions can be maintained with a minimum of 8 litres per flow.

Closely related to the tent method is the open top box, recommended for use in children by Burgess, Briggs and Burgess. The method is economical and the nursing is simplified. The same conditions of temperature and humidity must be maintained.

Barach has devised a hood which fits over the head enabling him to give oxygen and helium mixtures to asthmatics.

The mask method of oxygen therapy has received its greatest impetus since the construction of the Boothby, Lovelace and Bulbulian mask, which has been described in numerous papers. Barach and Eckman have recently devised a mask which gave an alveolar oxygen of 89%, and a carbon dioxide of 0.2% in the inspired air, with a flow of 6 litres per minute. The advantage of the mask method is that a high concentration of oxygen can be given with relatively simple equipment. Unfortunately, the face mask tends to become uncomfortable across the nose, and the nasal mask requires that the mouth be kept closed.

One of the commonest methods of giving oxygen is by nasal catheter. By this means Wineland and Waters obtained an alveolar oxygen concentration of 50 to 60%. The method is cheap, requires minimum supervision, does not interfere with nursing care, and, as with the mask method, several patients can be managed from one tank. It may fail, in that some patients object to the catheter; it may dry the mucous membrane and it is impossible to get a high concentration of oxygen. For adequate therapy and satisfactory results certain steps must be followed. The oxygen must be properly humidified with a humidifier which breaks up the oxygen into fine bubbles. The water level in the humidifier must be kept at the proper point. The catheter for adults should be about F. 14, with several holes bored within a half inch from the tip. The catheter must be properly placed, for, if inserted too far the patient swallows oxygen, if not inserted far enough the oxygen concentration is reduced. When inserting the catheter, the distance from the nares to the tragus should be measured, and the catheter inserted that distance into the nose; or, until the patient commences to swallow a bolus of oxygen. Then it should be withdrawn a little. The catheter should be changed every twenty-four hours, and the comfort of the patient will be greater if some analgesic ointment is smeared on it. In an adult the oxygen flow is started at 6 litres per minute. This method has been used successfully for several days at a time, even on infants a few days old, using, under these circumstances, a one to three litre flow, depending upon the oxygen requirement.

A method which has occasionally been tried is the intravenous method. However, it has not been very successful. Ziegler recently devised a new method for intravenous oxygen to be used in cases where the ventilating surface of the lung is seriously reduced or the patient has a congenital heart lesion with a patent foramen ovale. The author claims an improvement in patients who, hitherto, could not be adequately oxygenated.

To summarize, the physician should be able to predict which cases may have anoxia from a failure of their oxygen transportation system. In these cases efficient therapy will often save lives or reduce the convalescent period.

Resuscitation.—Attempts to restore respiration and circulation must be made before the lack of oxygen causes irreparable damage. Since this is a matter of minutes, resuscitation is an emergency treatment which Behnke aptly compares to the arrest of hæmorrhage. Usually artificial respiration alone is required; but in electric shock, in anæsthesia, in pulmonary and in cardiac operations it may also be necessary to treat acute circulatory failure. Cessation of respiration will, in itself, soon lead to cardiac arrest because of the resultant severe shortage of oxygen.

It is excellent that so many people are able to do some simple form of artificial respiration, but it is imperative that everyone should know this technique, because the recovery of an individual depends upon early efficient treatment. Valuable minutes are often lost waiting for the physician or the emergency squad to arrive. Birnbaum and Thompson have recently shown that in animals with acute asphyxia, manual artificial respiration revived 55%, whereas, mechanical pulmonary ventilation with positive and negative pressure, together with oxygen inhalation revived 95%. Behnke supports this idea when he says that in cases of acute respiratory failure with acute oxygen shortage the

object is to rid the lung of inert nitrogen as soon as possible and replace it with oxygen. Combined positive and negative pressure for a few minutes will accomplish this rapidly. Cassels points out that in the operating room, with ideal resuscitative measures, cessation of respiratory exchange, even with partial obstruction to the airway, should not be fatal. Under most circumstances, however, simple methods have to be employed. The following are some of the methods of artificial respiration.

Mouth-to-mouth or mouth-to-nose insufflation. —In this method a handkerchief or piece of gauze is placed over the mouth or nose, and the operator blows through it gently. In children, it is better to blow through the mouth so as to avoid the obstructive adenoid tissue. In adults, the mouth-to-mouth or mouth-to-nose insufflation is suitable. When inflating the lungs through the mouth, the nose should be pinched off and the chin held forward. When inflating through the nose, the mouth should be kept closed. This method of artificial respiration is very valuable in infants and children where the chest wall has very slight rebound, and in persons with fractured ribs where pressure on the thorax might be dangerous.

Manual artificial respiration. — The Schafer prone type is the favoured one with rescue squads, for the position of the patient helps the airway by keeping the tongue away from the palate and posterior pharyngeal wall; in addition, this procedure can be carried on for some time with less fatigue to the operators. Waters and Bennett found that the respiratory exchange was not as great with the Schafer as with the Sylvester method, but, in using this method it is more difficult to maintain the airway, as the patient is in the supine position. Other manual methods, such as the Nielsen prone, the Eve rocking and the Thompson lifting are favoured by some. Everyone should be familiar with one of these manual methods of artificial respiration. The three essential points to keep in mind are: to keep a patent airway, to exercise care lest one be too vigorous and break ribs or injure a viscus, and, finally, to maintain the body heat.

Numerous mechanical methods have been devised for use by experts, or where prolonged artificial respiration is required. The bag and mask connected to an oxygen tank permits the rhythmic inflation of the lungs. Behnke suggests an inflation every five seconds, using a maximum pressure of 15 mm. of mercury. He recommends placing the individual on the side and following the inflation by manual compression of the epigastrium to aid expiration. Flagg recommends using an endotracheal tube, to ensure a patent airway. For asphyxia neonatorum, Kreiselmann has devised a resuscitator for rhythmic manual inflation of the lungs. The apparatus has a blow-off valve set at about 12 mm. of hg. to prevent over-inflation of the lungs. Crafoord and Mautz have devised an artificial resuscitator for use in operating rooms where the closed circle method of inhalation anæsthesia is employed. It is difficult to see the value of such an appliance unless it is an effort to reduce the hazards from an incompetent anæsthetist. If prolonged artificial respiration is required, then a Drinker apparatus is used. Prolonged treatment is occasionally necessary in poliomyelitis, in overdose of sedative drugs, or in lesions of the spinal cord above the fourth cervical segment. In these cases secretions gather in the respiratory tract and have to be suctioned out. If the patient is unconscious either a pharyngeal airway or endotracheal tube has to be inserted. Wilson warns that in poliomyelitis the respirator should be used when there is paralysis of the diaphragm or intercostal muscles, but not when there is bulbar poliomyelitis with obstruction to respiration from pharyngeal paralysis. In the Drinker apparatus a negative pressure of 10 to 15 mm. of mercury should be used for infants and adults. As Wilson points out, if the negative pressure is too high then subcutaneous emphysema will develop, and if the ventilation is too active the patient will develop tetany. The main object is to rest the muscles of respiration and supply oxygen. For prolonged artificial respiration Behnke and Wilson both assert that positive pressure is unnecessary.

Considerable controversy has ranged about the use of analeptics for respiratory arrest. They certainly are not substitutes for artificial respiration. Eastman, Dunn and Kreiselmann observed that in resuscitation of the newborn, pure oxygen promoted a better recovery of blood pressure and respiration than did 10% carbon dioxide and 90% oxygen. Analeptics, such as coramine, metrazol and picrotoxin help considerably in drug depression. Henderson, however, states that in carbon monoxide poisoning an analeptic improves the patient at the time, but leaves him not as well the following day. It would seem, therefore, regarding the

use of analeptics that a slight improvement in respiration is ultimately better than a sudden complete arousal.

Occasionally it happens that there is also cardiac arrest. This accident can frequently be diagnosed by the marked pallor which occurs suddenly, soon followed by cyanosis which is unrelieved by a few inflations of the lungs. Hooker suggested exposing the heart and shocking it with an alternating current of 1.5 amperes applied for half a second. In addition, he recommends injecting calcium chloride and adrenalin into the carotid artery. Wiggers caused fibrillation by coronary occlusion, then attempted to revive the ventricles by using cardiac massage followed by countershock.

In the case of ventricular fibrillation, Beck and Mautz injected novocaine into the right ventricle or bathed the heart with 5% novocaine before attempting to revive it. However, judging by the reports which have appeared in the literature, it is obvious that measures to revive the heart have at times proved successful in cases of cardiac arrest. Aikenhead observed a case of cardiac arrest during spinal anæsthesia with full recovery following cardiac massage, carried on through the diaphragm. A similar case was observed by Hathaway during cyclopropane anæsthesia. Here, too, cardiac massage was carried on through the diaphragm, and recovery was complete. Numerous other similar instances have been reported.

To summarize, anoxia caused by respiratory or circulatory arrest should be corrected early. The oxygen deficit should be restored as soon as possible by artificial respiration or circulation. There are numerous methods of artificial respiration. The most important point is that everyone should be able to do, efficiently, some form of artificial respiration.

NOTE: An extensive bibliography has been prepared and may be obtained from the authors.

RÉSUMÉ

Le besoin de nos tissus pour l'oxygène sont tels qu'une période d'anoxie de 15 minutes seulement peut produire des effets irréversibles. L'anoxie, variable dans son intensité et dans sa durée, se manifeste toutes les fois que l'apport d'oxygène au sein des tissus est empêché. Les raisons de cet empêchement sont bien connues. Les signes initiaux de l'anoxie sont discrets et il faut les rechercher avec soin. La plupart des maladies qui s'opposent à l'utilisation efficace de l'oxygène sont favorablement influencées par l'oxygénothérapie, notamment, les maladies cardio-pulmonaires. Les méthodes d'administrer l'oxygène sont souvent fautives. Le moyen idéal serait la chambre à 45% d'oxygène mais ce procédé est coûteux. Puis vient la tente dont la surveillance des détails est difficile. La boîte ouverte est d'application plus simple; il en est de même du masque et du cathéter nasal. Lorsqu'il s'agit de ressusciter un individu la respiration artificielle est souvent suffisante, mais parfois il faut y ajouter l'inhalation d'oxygène, soit de bouche à bouche ou de bouche à nez, soit par le procédé de Schafer, soit encore par les nombreux procédés mécaniques bien connus. Que la cause de l'anoxie soit d'origine cardiaque ou pulmonaire, cette cause doit être traitée très précocement. Une forme quelconque de respiration artificielle devrait être connue de tous.

JEAN SAUCIER

SULFONAMIDES AND THE BLOOD SEDIMENTATION RATE

BY R. A. PALMER, MAJOR, R.C.A.M.C.

THIS paper reports observations on the sedimentation rate of red blood corpuscles during the administration of (1) sulfanilamide, and (2) sulfathiazole. The sulfonamides are used extensively in the treatment, and the blood sedimentation rate in the observation of infections. The question sometimes arises whether the sulfonamides influence the blood sedimentation rate except by acting on the infecting organism. Of course the most direct information on this point would be obtained by observing the blood sedimentation rate changes in normal persons during the administration of sulfonamides, but it seems undesirable to submit healthy busily occupied normals to the usual clinical dosage of the drugs. In 46 cases of acute lobar pneumonia Glenn[1] found no evidence that the use of sulfapyridine influenced the return to normal of the blood sedimentation rate.

In the absence of other available subjects these observations were made in unselected cases of acute gonorrhœal urethritis in attendance at the Venereal Disease Division of the Provincial Board of Health (B.C.). The presence of infection brings an uncontrolled factor into the experiment, but it is ordinarily expected that acute anterior urethritis alone will not significantly affect the blood sedimentation rate.[2] This was also shown in the present study, in which a preliminary reading of the blood sedimentation rate prior to treatment in 107 cases of acute anterior urethritis showed an average rate of 9 mm. in 45 minutes (Westergren normal, less than 15 mm.); this included a number of cases with high readings which were later found to be suffering some posterior extension of the disease.

METHOD

The blood sedimentation rate was observed according to the Westergren[3] method, using the 200 mm. tube and taking readings at 15 and 45 minutes. The reading at 45 minutes only has been shown in the graphs as the 15 minute readings did not seem significant. An observation was made just prior to treatment and at intervals of seven days during drug therapy. Eighty-five cases received sulfanilamide, and

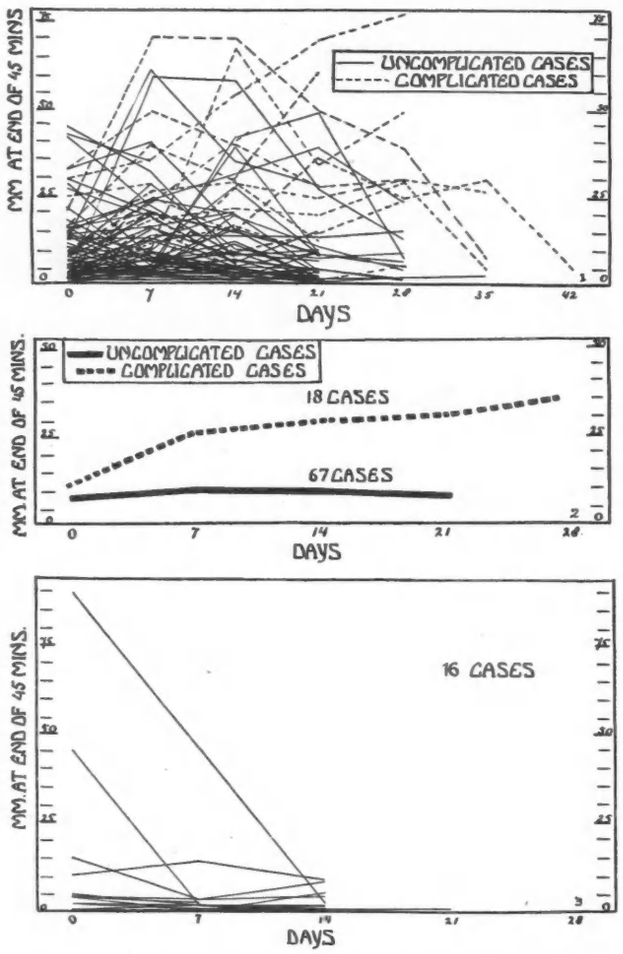


Fig. 1.—The blood sedimentation rate and sulfanilamide.
Fig. 2.—The blood sedimentation rate and sulfanilamide.
Fig. 3.—The blood sedimentation rate and sulfathiazole.

were given the following continuous daily dosage: 5.33 grm. for four days, then 4.0 grm. for four days, 2.66 grm. for seven days, 1.33 grm. for seven days (total 65.25 grm.). Sixteen cases received sulfathiazole and were given the following continuous dosage: 3.0 grm. the first dose, then 4.0 grm. daily for seven days, then 2.0 grm. daily for seven days (total 45.0 grm.).

DISCUSSION

Fig. 1 is a composite graph of the individual results in the cases receiving sulfanilamide. Sixty-seven cases were apparently uncomplicated acute anterior urethritis, while 18 had some obvious complication due to posterior extension of the disease (prostatitis, epididymitis, etc.) and are shown by broken lines on the graph. It will be noted that there is a distinct concentration of cases remaining within the normal range (less than 15 mm. fall in 45 minutes) throughout the whole period of observation, and no other general trend of sedimentation rate changes is apparent. The elevated rates are found chiefly in the cases with some complication of the infection, which is likely to be the chief factor involved.[2] Fig. 2 shows the averages of the sedimentation rates in the sulfanilamide-treated cases, and again indicates that, in the absence of the possible effects of infection, the administration of sulfanilamide produces no significant change in the blood sedimentation rate.

Fig. 3 shows the findings in a small group of 16 sulfathiazole treated cases. For the purposes of the graph it was not thought necessary to divide the cases into complicated and uncomplicated groups, or to derive the averages. It is seen that there is an obvious concentration of the cases remaining within the normal range for blood sedimentation rates, which strongly suggests that this is not significantly influenced by the administration of sulfathiazole.

SUMMARY

Blood sedimentation rate changes were observed in a series of cases of acute anterior urethritis, 85 of which received sulfanilamide, and 16 of which received sulfathiazole. The results of this study suggest that, apart from the factor of infection, the blood sedimentation rate is not influenced significantly by the administration of sulfonamides in ordinary clinical dosage.

Grateful acknowledgment is made to Dr. D. H. Williams, Director of the Department of Venereal Disease Control (B.C.), Capt. L. G. Wood, and Dr. L. R. Williams for providing and supervising the clinical material, to Miss Katherine Sutherland and Dr. W. R. S. Wilson for doing the laboratory work, and to Sgt. A. Dehen for preparation of the graphs.

REFERENCES

1. GLENN, W. W. L.: Blood counts and sedimentation rates in pneumococcal pneumonia and meningococcal meningitis following sulfapyridine therapy, *Bull. Ayer Clinical Lab. Pennsylvannia Hospital*, 1941, 3: 365.
2. WINTROBE, M. M.: The erythrocyte sedimentation test, *Internat. Clin.*, 1936, 2: 34.
3. KOLMER, J. H. AND BOERNER, F.: Approved Laboratory Technique, Appleton-Century, N.Y., 2nd ed., 1938, p. 104.

ALEUKÆMIC LYMPHATIC LEUKÆMIA, OR LYMPHO-SARCOMA

BY J. W. AULD

Calgary

THE following case although not completely investigated, presents many points of great interest.

A man, aged 41, was referred to me on April 27, 1942. He gave the history of having received an injury to the scalp in an automobile accident, two and one-half years before. He said that soon after receiving the injury a growth developed in the injured area; and that soon after the appearance of the first growth, many other smaller growths made their appearance on the scalp. He told me that at the same time the smaller lesions developed numerous flat pinkish-coloured lesions appeared on the forehead and sides of the face. Three months ago the left parotid gland became enlarged, tender and extremely painful.

Present condition.—Examination shows one tumour about the size of a walnut and many others of smaller size. These are symmetrically distributed over the scalp. They range in size from a split pea to a cherry. All the tumours are hemispherical, hairless, smooth, semi-solid, pinkish in colour, and attached to the skin, but freely movable over the deeper tissues. The skin is infiltrated with the growth. There is no "pearl formation". These growths are not tender and cause no discomfort. The forehead and both sides of the face are involved in a network of infiltrated plaques of many configurations; some are oval, some round, some angular and some in streaks. These lesions are pinkish in colour, flat, firm to the touch, non-tender, and raised about 1 mm. above the surface of the skin. Many of these lesions show telangiectases on their surface. They are freely movable on the deeper tissues. The skin is involved with the growth. The skin of the back is symmetrically involved, as is also that of the chest, with similar lesions. There is no pruritus. There are no lesions of any description on the limbs.

The left parotid gland is enlarged and causes severe and continuous pain, which radiates over the side of the face. The anterior and posterior cervical, submental, sub-maxillary, posterior auricular and axillary lymph nodes are enlarged and hard. There is no enlargement of the inguinal glands. The spleen is not palpable. The liver does not appear to be enlarged. The temperature at the time of examination was 99°; pulse 78; respirations 24. The patient seemed to be suffering from the effects of severe toxæmia, with evidence of many metastases.

Pathological examinations.—Red blood count, 5,200,000; white blood count, 12,200; Hgb., 87%; polymorphonuclears, 68%; lymphocytes, 17%; monocytes, 4%; basophiles, 3%; eosinophiles, 2%; Wassermann test, negative; urine, normal.

A biopsy taken from the larger growth on the scalp and examined by the pathologists in Calgary and in Edmonton was reported upon as being a type of lympho-blastoma, either aleukæmia or lymphosarcoma.

In the group of lympho-blastomas are included several diseases of lymphatic origin, which may develop in different ways and in different types of clinical expression. Included in this group are lymphatic leukæmia, Hodgkin's disease, mycosis fungoides, and, possibly, generalized non-pigmented sarcomatosis cutis. Eruptions in the broad group embraced by the term lymphoblastoma, are often very difficult to identify by either clinical or microscopic methods. If the tumours are the only manifestation of the disease, and the blood remains persistently normal, the condition is considered to be aleukæmia. There is usually local enlargement of the lymph-nodes with only slight enlargement of the spleen.

Multiple lymphosarcoma, a variety of sarcoma, may show itself as a chain of enlarged lymph-nodes. There may be a single tumour or multiple tumours more or less symmetrically distributed over the face, trunk and upper extremities. These tumours may be conical or flat. They are firm and painless, attached to the skin but not to the underlying tissues.

Generalized non-pigmented sarcomatosis cutis in many respects seems related to the lympho-blastomas. This type of lesion may develop from a single cutaneous growth, or may be multiple from the beginning. The sarcomata must be differentiated from leukæmia cutis and mycosis fungoides, which they closely resemble. Even histological findings at times will not permit a definite distinction between these disorders. Sarcomas, whether primary or secondary, are said to be amongst the rarest of malignant conditions of the skin. In most cases the process is secondary to growths commencing in the lymphatic glands or deeper structures. It may develop at the site of injury.

Further investigation is necessary in the case. A complete radiographic examination should be made. Proof of the presence of a primary tumour causing a secondary metastatic sarcoma of the skin is sometimes difficult or impossible. Several biopsies should be made, and the blood should be repeatedly examined. A sternal puncture for examination of the bone marrow might be helpful.

The treatment in a case of this kind is anything but encouraging. The outcome sooner or later is fatal. Arsenic may do good; liver extract may be of benefit; x-ray therapy may prolong life. There is, however, danger of fatal toxicosis in a condition of this kind, if too large an area is irradiated at one sitting.

On first seeing this patient, I was convinced that his was a malignant condition; a type of lymphoblastoma — either lymphatic leukæmia cutis, lymphosarcoma, or generalized non-pigmented sarcomatosis cutis. After receiving the blood report, I was of the opinion that the condition was aleukæmic lymphatic leukæmia, or one of the types of sarcomatosis cutis. I am in agreement with the pathologist that this case is one of aleukæmia or lymphosarcoma. It is to be regretted, however, that further investigation has not been possible.

GALLBLADDER DISEASE AND THE X-RAY

BY DEAN MACDONALD, M.D., F.A.C.S.

St. Catharines, Ont.

THE use of the x-ray as an aid in the diagnosis of biliary disease is not so simple as it is usually supposed to be. This mistaken idea is particularly prevalent in general practice. The interpretation is not merely a question of giving the dye and determining whether there is, or is not, a resultant shadow. There are many variables, both in the technique of dye administration and in the interpretation, each of which is a potential source of error. It is therefore easy to understand that mistakes may be not only frequent, but often unrecognized. However, when properly performed and evaluated from the clinical viewpoint, cholecystography will give 95% accuracy. This is in marked contrast to the 50 to 75% accuracy sometimes obtained in general practice and is, in itself, sufficient reason for the present discussion. The subject will be discussed under the following subheads. (1) The flat plate; (2) the gastro-intestinal barium series; (3) the technique of dye administration; (4) the physiology of cholecystography; (5) the contraindications; (6) the fluoroscopic study; (7) the filling phase and the emptying phase; (8) the diagnosis of calculus; (9) the interpretation in jaundice; (10) the final interpretation in view of all findings (and causes of failure).

THE FLAT PLATE

No other single x-ray film can give so much information as the flat plate, providing, of course, that the patient has been properly prepared. The bowel and bladder must be empty and the interpretation made by an experienced roentgenologist if the best results are to be obtained. In fact, under any other conditions the flat film may be misleading, because a wrong interpretation may mean surgery with all its added dangers, in addition to a poor end-result. Schatshi has noted that more than one hundred conditions can at times be differentiated, many of which, relatively, are associated with biliary disease. These have to do with the size and shape of the liver and spleen, calcification and position of the gallbladder, position and size of the kidneys, abdominal aneurysm, sclerosis of the abdominal vessels, and conditions of the spine which might give painful symptoms resembling colic (arthritis, injuries, tuberculosis). Calcified lymph glands, calcified costal cartilages, and renal calculi may be mistaken for gallstones but should actually be a help in diagnosing calculi on the dye plate by showing the relative and absolute position of the shadow. The laminated shadow is practically always a biliary calculus, in contrast to the dense gland.

The bile ducts may become filled with air which will outline them. This indicates a communication (internal fistula) with the stomach or colon, or, more rarely, the duodenum. This is a rare finding but should be appreciated when seen.

The pancreas has recently been studied by a lateral film in which the stomach is filled with air. The distance from the stomach to the spine is increased in pancreatic enlargement. This finding may be confirmed by the gastro-intestinal barium meal, but is yet of little practical value in general practice.

THE GASTRO-INTESTINAL BARIUM SERIES

Because the symptoms of gallbladder disease can be so misleading, and the diagnosis so difficult for the doctor in general practice it is always wise to order a complete gastro-intestinal series (which includes a barium enema) as well as the gallbladder x-ray. The benefit more than compensates for the extra trouble and expense.

The presence or absence of gastric or duodenal disease must be searched for. This consists particularly of peptic ulcer, gastric neo-

plasm, pyloric and duodenal spasm, duodenitis, and duodenal diverticulum. The latter, unless the seat of inflammation, rarely gives symptoms. A rough superior surface of the duodenum is not uncommon after operation, and is not abnormal. The mobility of the organs and areas of tenderness should be determined by fluoroscopic examination.

Disease of the colon, which may produce the symptoms of cholecystitis, is often missed and a barium enema will decrease the incidence of such mistakes. Diverticula may retain barium for several days and if one is in the vicinity of the hepatic flexure it may be mistaken for a stone.

Contrary to general opinion, x-ray examination of the appendix following a barium enema should be very satisfactory. It may even be better than the clinical examination, because it presents a method of visual palpation of the cæcum, appendix and ileum. The maximum point of tenderness can be located in relation to other structures and the presence of a mobile or sensitive cæcum can be determined.

THE TECHNIQUE OF DYE ADMINISTRATION

Because of the difficulty in the interpretation of faint shadows it is always wise to give a double or triple dose. This ensures, for all practical purposes, a dense shadow in the normal gallbladder. There are many modifications of the original technique and numerous technical details have been suggested, but for the sake of simplicity only one will be outlined. This has been found to give the highest percentage of diagnostic accuracy of either medical or surgical conditions.

1. A fat diet is prohibited *throughout the test,* but is used for one day before taking the dye, to empty the bladder. This prevents dilution of the dye-laden bile after it enters the bladder and is most necessary in obese patients because it produces a more dense shadow.

2. Meals of carbohydrates and sugar drinks are preferred.

3. For the patient weighing up to 150 to 170 pounds, a *total* of 6 to 9 grams should be given; for the heavy patient weighing up to 200 pounds and over, a *total* of 12 grams must be administered, or an amount close to it depending upon the size of the dose in the package used. For example, three 3.5-gram packages are the same as two 5-gram packages.

4. For the small patient one-quarter of the total dose is given after a light noon-day meal, and another quarter at tea time. The remaining one-half dose is given later in the evening. Fresh fruits (but not olives) and fruit drinks are allowed during the evening.

5. For the heavy patient an extra day is required for preparation. The first dose (one-quarter) is given after an evening meal, the second dose (another quarter) following a light luncheon the next day and the third dose (one-half) the same evening. This dose can be divided further if nausea is likely.

6. Vomiting should be avoided if possible. There is enough absorption for a fair shadow in a large patient and a good shadow in a thin patient, from dye which is not vomited for one-half hour. Small doses of soda bicarbonate (one drachm in one glass of water) or Tinct. Camphoræ Co. (*m* x), will often relieve nausea.

7. (*a*) A small dose of paregoric (*m* xv) the night before the x-ray will prevent diarrhœa which might empty the bladder, and so give no shadow. It will also increase the pressure resistance of the sphincter of Oddi and therefore predispose to a more dense shadow. (*b*) Pitressin (½ c.c.) one-half hour before exposure will usually remove any trouble-giving gas. (*c*) An enema, if well given without the injection of air, may sometimes be indicated the morning of the film.

8. No breakfast is allowed; even the smell of food may empty the gallbladder. If this happens the dye should be seen in the bowel if a normal mucosa has concentrated it sufficiently.

9. The first films are taken at 9 a.m. If this shows a normal dense shadow more exposures are not necessary, but if the shadow is below normal density the filling phase is allowed to continue, and the density again determined in 3 to 4 hours. It is desirable, if possible, for the second set to be made even if the first plate shows a normal shadow because, if the filling phase is slow, this is one method of showing the elasticity of the bladder wall.

10. The fatty meal is not given until it has been definitely determined that the gallbladder concentration is, or is not, normal. This meal consists of at least one egg (preferably two) milk, cream, and butter, in addition to other foods which the patient may desire. If possible the first films of the emptying phase should be taken within one-half hour after the fatty meal, and the second within one hour of the meal. If the emptying is shown to be abnormal in any

way more exposures are made at the three-hour period, and if necessary a third set the following morning. This is necessary if the slowly emptying (functional) bladders are to be discovered. It also shows the elasticity and contractile power of the bladder wall better than the filling phase.

THE PHYSIOLOGY OF CHOLECYSTOGRAPHY

The dye is an iodine compound of phenolphthalein. When given orally it is absorbed into the abdominal venous stream and carried to the liver by the portal system. Here it is excreted into the bile channels which convey it through the hepatic ducts to the extrahepatic system. It is diverted into the cystic duct and gallbladder with the other bile when the sphincter of Oddi is closed. Hence the importance of a fat-free diet during the period of the test. The same mechanism of excretion applies to the intravenous administration, the only difference being that the amount entering the blood stream is definitely known in the latter case, whereas by the oral method the amount administered might not be completely absorbed from the intestine, and when this occurs the interpretation of the resulting absent shadow *might* not be correct. This is overcome by the administration of a double dose. The intravenous method, however, has certain disadvantages and in the opinion of many authorities is not necessary because the repeated dose, which will give an accumulated amount of dye in the blood, is always sufficient to give a good shadow in the normal gallbladder. It is a pernicious practice to introduce foreign material into the blood without a definite reason. Reactions are not common, but they do occur, and if they take the form of local venous thrombosis they are serious. It is also difficult to find a vein in many heavy patients. For these reasons, and because recent authoritative statistics show the reliability of the oral method, the intravenous method need never be used.

In the repeated-dose-technique the concentrated dye will leave the gallbladder with the bile and enter the intestine following gallbladder evacuation. This dye is then re-absorbed and carried back to the liver through the portal system, as it was originally in the non-concentrated form, and is again excreted by the liver to enter the gallbladder for the second time, and possibly even for the third time. At the same time the recently taken dye is also being absorbed. In this way the amount of dye circulating in the blood and being excreted by the liver, becomes increasingly great so that the failure to obtain a shadow cannot be said to be due to deficient absorption; hence the reliability of the repeated doses.

THE CONTRAINDICATIONS

The only contraindications for cholecystography occurs when the intravenous method is used. This carries with it certain risks in old or debilitated patients, in the hypertensive, and in the jaundiced or very sick patient. The mode of administration, and not the dye, offers the danger. There are no contraindications for the oral method, particularly if plenty of sugar is given with the dye for the protection of the liver cell. Experimental work has shown that the excretion of the dye is not injurious to the liver. However, if a large amount of concentrated dye is suddenly brought to the partially deficient liver, as by the intravenous route, it might precipitate a certain degree of liver failure. If the liver cell is sick and overstrained, such extra work may become "the straw that broke the camel's back".

THE FLUOROSCOPIC STUDY

A fluoroscopic study of the chest should always be made, and the heart, aorta and lungs carefully investigated. (This point was pressed home to the author when he made a diagnosis of possible gallbladder disease in a patient in whom fluoroscopic study revealed a small bronchogenic carcinoma. Total pneumonectomy by Dr. Norman Shenstone, Toronto, gave complete relief to his dyspeptic symptoms). Other chest abnormalities may also be the cause of symptoms which simulate, if not imitate, gallbladder disease. These can often be discovered by fluoroscopic study.

The double or triple dose method will give a cholecystic shadow in the not-too-fat patient which can be seen and palpated by fluoroscope. The mobility of the gallbladder and duodenum and the relative points of maximum tenderness, can be definitely ascertained. The appendiceal region is always examined by fluoroscope after a barium enema.

A thorough fluoroscopic study of the stomach and duodenum after the barium drink is often of greater value than the series of plates, particularly in the differential diagnosis of duodenal disease (ulcer, spasm, duodenitis).

THE FILLING AND EMPTYING PHASE

The interpretation of the filling and emptying phases are important from two angles: (*a*) the changes in the density of the shadow and (*b*) the changes in the size and shape of the shadow. These changes can not be determined unless two sets of films are taken of each phase. Whenever possible the second set of plates should always be made. The clinical importance of the rate of emptying is greatly underrated, and this can only be seen if the second set is made for purposes of comparison. This may reveal a calculus which otherwise would be missed. A gallbladder with normal concentrating power and no fibrosis in its wall, will increase in density and change in size and shape during the filling phase (from the first to the second set), and after the fatty meal will have decreased in size at the thirty-minute picture and may have completely disappeared at the one-hour period. The density is also likely to decrease. These changes in density, size, and shape, are indicative of normal gallbladder concentration and a non-fibrotic wall. They form the basis of roentgenologic diagnosis and cannot be seen with single exposures.

THE DIAGNOSIS OF CALCULUS

The diagnosis of calculus can be made (*a*) in the flat plate as a direct shadow; (*b*) in the filling phase as a markedly changed area of density; (*c*) in the emptying phase as either a changed area of density or as a direct shadow of the stone on which some of the dye has been retained. Among the conditions which might be mistaken for a stone are renal calculi, calcified costal cartilages, calcified glands, gas in the colon or duodenum, retained barium in the colon and impacted fæces.

THE X-RAY IN JAUNDICE

In jaundice the x-ray is of value because it may indicate: (1) the absence of inflammatory disease; (2) the probability of pancreatic carcinoma; (3) combined with the bromsulphalein dye, the probable presence of intra-hepatic disease.

There are two arguments against using the dye in the presence of jaundice. The first is that it is dangerous, and the second is that if the liver cell can not excrete the bilirubin it can not excrete the dye, and it is therefore useless. Both of these arguments have been proved wrong by clinical experience. It has been shown repeatedly that the dye, if administered in divided doses by the double dose method and with sugar, has no dangerous effect on the liver or the patient. Indeed it has often been given by vein, but this is not recommended.

It has also been proved that a normal gallbladder shadow can often be seen in a jaundiced patient. The fallacy in the argument that the liver cell does not excrete the iodine compound in the presence of jaundice is simply that the liver cell *does* excrete it. In some instances it even excretes more than in health; it not only excretes the normal amount but also some of that which is brought back to it because of ductal obstruction. It is therefore capable of passing the dye from the blood to the bile channels. Animals which have been given large amounts of chloroform anæsthetic will pass the dye from the blood to the bile even though the liver is badly damaged. It is, of course, obvious, that if the liver damage is very great the dye will not get past the liver cell, and this point is said to be reached when the bromsulphalein dye shows a retention of 40% or more at one-half hour. This may even occur in the absence of jaundice. Some clinicians give the bromsulphalein dye before the x-ray dye, and if the bromsulphalein dye shows a retention of over 40% the absence of the gallbladder shadow may not be the result of bladder disease, since a normal bladder can be present but it gives no shadow because sufficient dye does not reach the bile channels. On the other hand if the bromsulphalein shows 0 to 20% retention, then the absence of a shadow is positively not the result of intra-hepatic disease; 20 to 40% is doubtful.

Interpretation.—1. If a gallbladder shadow is produced in the presence of jaundice it shows that a normal bladder mucosa with good functioning and concentrating power is present, and the probability is great that infection is, and has been, absent. The cause of the jaundice is not, therefore, likely to be stones, cholecystitis, cholangitis, etc.: it is non-inflammatory.

2. If the shadow does not disappear after the fat meal it indicates obstruction distal to the junction of the cystic and common ducts, and non-inflammatory obstruction. This is usually carcinoma of the head of the pancreas.

3. If the shadow does disappear normally, there can be no obstruction and the jaundice must be intra-hepatic and not associated with extrahepatic ductal inflammation. This is most often caused by a hepatitis.

THE FINAL INTERPRETATION

The interpretation and final diagnosis must be considered in association with all the findings. This often requires great experience and a sound basic knowledge of biliary physiology. It also demands more than a "smattering" of the history. For instance, the presence of a duodenal ulcer can produce a poor shadow and of itself might be the cause of symptoms. The late appearance of a dense shadow points to poor liver secretion particularly if the shadow is normal in every other way. The liver therefore should be suspected in such cases as the cause of symptoms and if possible the single estimation bromsulphalein dye test should be done in all suspicious cases. If this shows a retention above 35 to 40% at one-half hour the liver cell is much below par as an excretory unit and almost prohibits the appearance of a good shadow. On the other hand, if the dye excretion is normal the absence of a shadow is positively not the fault of the liver. Late emptying or poor emptying may be due to cystic duct obstruction by a calculus, or œdema, but in the majority of cases, it can be said that if this obstruction is enough to give poor emptying, it is enough to give sufficient cholecystic disease to prevent good concentration; poor emptying is therefore not a sign of organic disease but a sign of functional disease.

No change in the contractility or distensibility of the gallbladder shadow means a diseased gallbladder wall (fibrosis) even if the shadow is good. The wall can be diseased but the mucous membrane can still concentrate and produce a shadow. Such a condition is sometimes, but rarely, the cause of symptoms in that the reservoir action or balance wheel of the ductal pressure regulatory apparatus has disappeared.

The absence of a shadow by the repeated dose method, or the repeated absence of a shadow by the single dose method, is, for practical purposes, pathognomonic of the presence of chronic cholecystitis, but this does not prove that it is the cause of the symptoms.

From what has been said it is evident that a diseased gallbladder will give an absent or abnormal shadow in practically every case, but that the normal bladder might give a pathological x-ray result. This is rare and is usually due to poor technique, but may occasionally result from appendiceal or colonic disease, or peptic ulcer. All negative shadows, if only a single dose has been administered, must be repeated. The finding of the dye shadow in the bowel means that the gallbladder must have concentrated the dye, else it could not be seen, and it is therefore a sign of a concentrating viscus. Calculi are visualized directly in 40 to 60% of cases and indirectly in 95%.

The value of the x-ray findings is greatly increased when interpreted in the light of the history and laboratory findings, and the diagnosis becomes more positive when a complete gastro-intestinal x-ray investigation has also been done.

Case Report

EARLY GENERAL PARESIS AND ASSOCIATED PULMONARY TUBERCULOSIS TREATED WITH ARTIFICIAL FEVER*

BY J. C. MEAKINS AND RICHARD D. MCKENNA

CASE HISTORY

M.D. (42/1162), an unmarried thirty-two year old French-Canadian woman, was admitted to the Medical Service of the Royal Victoria Hospital on January 26, 1942. She was referred by the Laurentian Sanatorium for investigation of vague dyspepsia, emotional instability, insomnia and coarse tremor of the hands. All of these symptoms were of approximately four months' duration.

In 1939 (October), following upon a three-months' history of cough with sputum, she had been found to have bilateral pulmonary tuberculosis, with a large cavity in the right upper lobe and a positive sputum (Gaffky III). Activity of disease in the left upper lobe was questionable. A right artificial pneumothorax was instituted in November, 1939, and a pneumolysis in August, 1940. Sputum and stomach washings had been negative since this time and her response to therapy was considered satisfactory.

A positive Wassermann test was noted on her admission to the sanatorium, but no antiluetic therapy had been given.

Enquiry on admission to the Royal Victoria Hospital revealed that the patient had had intercourse with various men since 1927 and one of her male friends in 1936 had later told her that he had a blood disease. There had been no recognized primary or secondary eruption.

Examination on admission showed: Temperature 99° F. (oral); pulse 80; respirations 20; weight 114 lbs. Blood pressure: 114/80, both arms. Development was good, nutrition fair. The chest was symmetrical in shape with signs of a right pneumothorax, impaired resonance at the left apex with harsh breath sounds. No post-tussic râles were heard in the chest.

* From the Department of Medicine, McGill University Clinic, Royal Victoria Hospital, Montreal.

There was evidence of psychomotor excitation (volubility, laughing and crying easily). There was considerable anxiety over her status, but insight was good. There were no other abnormal neurological signs on physical examination and the remainder of the physical examination was essentially negative.

The urine was negative on several examinations. There was a slight hypochromic anæmia (hgb. 78%), white blood cells 7,600, blood sedimentation rate (Wintrobe) 30 mm. (corrected for packed cell volume). The blood Wassermann test (Eagle) was positive in a dilution of 1:256; spinal-fluid Wassermann was positive in dilution of 0.025 c.c. Cell count (lymphocytes) was 24. Proteins 77.4 mgm. %. Lange: 2.5, 4, 4.5, 4.5, 5, 4.5, 4.5, 2.5, 1, 0.5, 0, 0. Sputum and stomach washings were negative for tubercle bacilli on smear and culture. Cystometrogram showed a marked hypotonia of the bladder. X-ray of the chest was interpreted as showing a satisfactory collapse of the right upper lobe and evidence of old tuberculosis, with fibrous scarring in the left apex. A diagnosis of early G.P.I. and quiescent tuberculosis was made.

Artificial fever therapy was instituted (the G.E. inductotherm fever cabinet was used) and 14 treatments were given at intervals of 4 to 6 days. In all, the patient's temperature was kept over 105° F. for 56 hours and over 106° F. (rectal) for 12 hours. These treatments were well tolerated.

The intervals between fever-cabinet therapy were uneventful. Temperature and pulse rate remained at pre-treatment levels. Weekly refills maintained a satisfactory collapse of the right upper lobe and cavity. Tryparsamide was given at weekly intervals during the last month and a half.

There has been no progression of mental changes and her mental, physical and emotional status appear to be entirely satisfactory. Repeated films of the chest show no progression of the tuberculous disease process.

COMMENT

The coincidence of pulmonary tuberculosis and advancing neurosyphilis is a difficult and not often encountered therapeutic problem. Exposure to over-heating and sunlight has been considered harmful in the presence of pulmonary tuberculosis. Confrères in mental and tuberculous institutions in this area have met this problem in the past with therapeutic malaria; their results were uniformly disastrous. In our case the tuberculosis was considered to be under control and the calamitous effect of allowing the neurosyphilis to go on without energetic treatment was appreciated.

The literature on the subject of tuberculosis and hyperpyrexia is scanty, and largely of an experimental nature. Since the five-hour death-point of the human type of tubercle bacillus is approximately 120 to 130° F. the treatment of pulmonary tuberculosis by fever therapy does not seem to be experimentally justified. Great caution has been urged by many in the use of hyperthermia. Neymann[2] quotes the work of Major, Doub and Hartman on artificially produced pulmonary infection in dogs, with human tubercle bacilli. Four of eight infected animals were improved by hyperpyrexia, whereas four of his treated animals died. All the controls succumbed to the infection.

Duncan and Mariette[1] showed with *in vitro* experiments that whereas five different strains of human type tubercle bacilli grew luxuriantly in temperatures ranging from 96 to 100° F., they grew poorly between 102 and 104°, and not at all above this temperature (bovine strains grew luxuriantly from 96 to 104°). The same authors treated 19 cases of pulmonary tuberculosis with artificial hyperpyrexia and reported that 16 had thereafter shown x-ray evidence of improvement.

SUMMARY

1. A case of coincidental early paresis and pulmonary tuberculosis treated by artificial fever therapy (G.E. inductotherm fever cabinet) is reported.

2. There was no evidence of reactivation of the pulmonary disease from this therapy.

REFERENCES

1. DUNCAN, G. R. AND MARIETTE, E. S.: The treatment of pulmonary tuberculosis by hyperpyrexia, *Ann. Rev. Tuberc.*, 1935, 31: 687.

2. NEYMANN, C. A.: Artificial Fever Produced by Physical Means; its Development and Application, Thomas, Springfield, 1938.

The operation of trepanning is very ancient, and was seldom performed without great caution. A proof of this is given in the early history of Ireland. Connor MacNeassa, King of Ulster, that generous protector of the literati of his day and contemporary with Julius Cæsar, having his skull fractured in battle, his first surgeon, Finighin, refused to apply the trepan till his safety was guaranteed by the nobles of the country in case it did not succeed. Vidus Vidius tells us that Perusius, a Roman surgeon of his time, averred that more people recovered without the use of the trepan than with it.—William Wadd.

Editorials

POSTPONEMENT OF THE 1943 ANNUAL MEETING

THE regular annual meeting of our Association which was to have been held in Montreal next June has been cancelled and will be replaced by a business session only. The matter was discussed fully at the meeting of the Executive Committee in Ottawa in October and it was only with the greatest regret that this decision was taken.

It was recognized that the educational and scientific advantages of the meeting should yield place only to imperative necessity, but that necessity does exist in the form of the national demand to limit travel to the utmost, and to concentrate the energies of our profession on the immediate and heavy tasks of the day. We shall thus forego much that is useful, even valuable in the war effort, such for instance as the dissemination of scientific advance in treatment of burns, shock, etc. But such sacrifice is part of the bitterness of war and we shall accept it.

Further announcements will be made regarding the meeting of Council.

MOTOR VEHICLE ACCIDENTS

THOSE who have followed the statistics of motor vehicle accidents will recall that in the last five or six years determined efforts have been made to lower the extremely disconcerting number of fatalities from this source. Until this year, however, these efforts were not successful. Both in Canada and in the United States the motor fatalities for 1941 reached the highest point on record. In the States there were 40,000 deaths from this cause and in Canada there were 1,848. The comparative figures for the previous years are as follows:

DEATHS AND DEATH RATES FROM MOTOR VEHICLE ACCIDENTS IN CANADA*, 1936-40

Year	*Number of deaths*	*Death rate per 100,000 population*	*Total motor vehicle accidents*
1936	1,316	11.9	29,119
1937	1,633	14.7	39,932
1938	1,545	13.8	39,645
1939	1,584	14.0	40,812
1940	1,723	15.2	49,967
1941	1,848	16.2	

*Exclusive of Yukon and the Northwest Territories.

The statistics for the present year are not yet available, but in the United States the National Safety Council has announced a gratifying drop in traffic deaths for June, 1942, the decrease being 32% of the June 1941 figure.

This is encouraging, but only up to a certain point. Can the improvement be attributed to these efforts of the various safety organizations? The terrible record for last year is against that conclusion. It looks rather as if it was only one of the side results of the war, arising from the diminution in the number of vehicles actually in use, and possibly to the limitation in speed. In Alberta apparently this last factor is accepted as a factor in having reduced motor accidents so far this year by nearly 50%.

If this is so, there should be no relaxation in our efforts at prevention of what is still a major source of death in our population. A recent report to the A.M.A. by Dr. B. R. Shirley (*J. Am. M. Ass.* 1942, **119:** 653) suggests, wisely, we think, that the medical profession has a part to play in warning the public with regard to this rising tide of mortality and showing how at least some accidents are preventable. Deaf people should take special precautions, such as equipping their cars with outside rear-view mirrors. The presence of epilepsy should be ground for refusal of a driver's license. The rôle of alcohol is probably one of the most important factors in the accident rate; it is likewise one of the most difficult to deal with. It has been observed that fatal traffic accidents involving reported drinking by drivers increased 28%

in 1941 (in the United States), and a large proportion of these alcohol accidents occur amongst workers in war industries.

This latter point has been emphasized by the National Safety Council, since a large proportion of the fatalities this year have been amongst workmen travelling to and from factories. The tendency is for more people to travel together in one car and this increases the number of injured in any one accident.

Dr. Shirley also points out that the physician has a responsibility in helping to control drinking drivers. On his examination depends the prosecution and punishment of a driver, or disproof of the charge. Physicians therefore should acquaint themselves with both the medical and legal aspects of tests for drunkenness. It has happened before now that a single slip in the technique of taking blood has entirely nullified the value of the evidence. It will always be difficult to define exactly the point at which the amount of alcohol in the blood so impairs the capacity to drive that the individual may be said to be "under the influence", but there are certain accepted chemical standards for the legal interpretation of that term.

The report concludes with a comment on the driving hazards amongst doctors themselves. Preoccupation and fatigue, especially in these latter days of overwork, are two dangerously insidious factors, and should always be borne in mind.

THE NEW RESTRICTIONS ON THE USE OF QUININE

UNTIL recently, about 90% of the world's supply of cinchona bark, the source of quinine, came from Java. Obviously, it is now necessary to see that quinine stocks are used to the best advantage. This is to be accomplished by an order of the Controller of Chemicals which became effective October 1 and which is published in the news section (General) of this issue. Similar orders are already effective in the United States and in Australia.

This order will have no adverse effect upon the health of Canadians. The only serious disease in the treatment of which quinine is valuable, is malaria. Considering that the incidence of this disease is very low in Canada there should be enough quinine to last for a long time if it is conserved. Perhaps some may even be spared for regions where malaria is a greater problem than it is here.

For the other purposes for which quinine is used—as a constituent of tonics, as an antipyretic and analgesic, as a uterine stimulant, etc.—there are better drugs. Some favourite prescriptions may go overboard but no real harm will result.

So far as tonics are concerned quinine is incorporated chiefly because it has a bitter taste. As an antipyretic and analgesic it is a feeble drug. There are several which are better. Quinine should have gone out of use for the reduction of fever and the alleviation of pain when antipyrine, acetanilide, phenacetin and acetyl salicylic acid became available. In obstetrics, those accustomed to use quinine more or less as a routine may feel the new restriction, but they will have difficulty in proving that they cannot attain their end as well or better, though perhaps with less convenience, with pituitary extract.

Perhaps it is fortunate that we have been employing quinine so extensively, even if ineffectively. It has led to there being more on hand than would have been the case if the demand had been for the treatment of malaria alone.

R. L. STEHLE.

Editorial Comments

Height and Weight Survey of Toronto School Children

An interesting report is now available* on the comparison between two studies of the height and weight of large groups of Toronto elementary school children. The first of these studies was made in 1923 on a group of 59,000 children; the second in 1939 on a group of 78,000. The statistical analysis of the latter was only completed in 1942.

The first study was made at a time when vigorous public health measures were being taken in Greater Toronto for the improvement of the general health of children. It has been felt in the last few years that the results of this work were beginning to be evident in the increasing height and weight of school children, since these did not conform generally with the figures obtained in 1923, and the second survey was therefore undertaken. In addition, this second report analyzes the influence of such factors as economic status, and the relation of the stature of the child to his academic standing.

One of the most striking findings has been the definite increase in the average height and weight of children of the later period. The average height of a 15-year old boy in 1923 was 61.6 inches, and in 1939 it was 63.9, or an increase of 3.9%. In weight, there was an average increase from 103.2 pounds to 111.6 (8.1%). The average increase amongst girls of that age group was somewhat less but still quite definite, 2.3% in height and 4.9% in weight.

The stature of the children has also been found to bear a relationship to the status of their parents. For example, the boys of labourers and unskilled workers have shown a percentage increase in height, over the average of only 17.3, whilst amongst the boys of professional workers the increase over the average has been 34.4%. Amongst the girls the variation between the same groups is even more pronounced, rising from 20.6% in the labouring class to 38.5% in the professional.

Again, the relation of the children's stature to his academic standing is of some interest. Those boys who were in grades higher than their age, (up to two years younger than the base age) showed an increase in their gain in height of 38.2%, whilst those older than the base age of their grade showed no more than 11.6% increase. Amongst the girls there was a corresponding increase, but again greater in degree.

The report is of especial interest in showing the range within which nutrition affects the build of children, and may well be taken as an additional proof of the value of improved feeding.

* A Height and Weight Survey of Toronto Elementary School Children, 1939. Published by Authority of the Hon. Minister of Trade and Commerce, Ottawa, 1942. Price 25c.

Retrospect

THE NEWER BACKGROUND FOR THE STUDY OF KIDNEY DISEASE

BY J. F. A. MCMANUS, CAPTAIN, R.C.A.M.C.

In the hundred years or more that have passed since Richard Bright produced the first volume of his "Report of Medical Cases" and described the kidney disease since associated with his name, there has been a tremendous output of published material. Most of this is of a descriptive nature, although experimental work cannot be said to have been neglected. However, disappointingly little has been forthcoming to elucidate the mechanisms by which the pathological changes are brought about.

Bright described the combination of dropsy, albuminous urine, and diseased kidneys, and noticed the fleshy, thickened wall of the left ventricle which is now recognized as the hall mark of the hypertension so commonly associated with kidney disease. It is especially in the explanation of the inter-relation between diseased kidneys and elevated blood pressure that the century of effort has proved barren.

A proportion of the failure might be considered to be due to a misdirection of effort, with an undue emphasis placed upon terminologies and classifications. The grocer may sort out the canned goods delivered to him and place each variety in a certain position in his shelves, but, when the task of sorting is completed, he is as ignorant of the process of canning as he was in the beginning. To extend this homely illustration, he may open a certain proportion of the cans, describe what he sees, and affix to each type a label, a mixture of Latin, Greek and English terms, but when he is finished, the initial ignorance is not decreased but added to, owing to the fog of terminology.

Within the past ten years a number of significant, though not closely related, publications have appeared and these, in the aggregate, seem to furnish new bases and backgrounds for the study of renal disease. Some of these studies return to the architectural fundamentals, some

of them combine clinical research with histology; some again are set in the grand scheme of the purest research in which a reasonable hypothesis is put to the test of careful experiment. It is the purpose of this review to outline these recent promising reports.

THE ESSENTIAL UNITY OF RENAL DAMAGE

As is natural, attempts have been made to produce acute and chronic Bright's disease (or glomerulonephritis) experimentally. To this end a great variety of substances have been introduced by every available route into almost every species of laboratory animal. Some of the introduced substances have been (1) chemicals, heavy metals, etc.; (2) others have been bacteria and their products; (3) others again have been of the nature of antibodies produced in other species against the kidneys of the animal attacked. There has been, and is, considerable disagreement concerning the degree to which these experimental assaults have resulted in damage strictly comparable to clinical Bright's disease. Without arguing that point, certain features have arisen from these experiments and from the study of human kidney disease which seem worth some discussion.

1. *Mercury* produces an extremely characteristic type of lesion in the kidney with the initial damage mainly in the tubules. Clinically, "the bichloride kidney" is a moderately familiar finding following the ingestion of this most common form of mercury. Comparable conditions can be produced with ease experimentally. There is found, at autopsy, widespread destruction of the tubular epithelium, and regeneration and calcification are common findings if the survival period is sufficiently long.

At first glance, and this is the common opinion, the glomeruli are spared. However, if careful microscopic examination is made by means of higher magnifications, pyknotic nuclei are found in the glomeruli and other features of glomerular damage, to the point of cellular necrosis, can be made out. In cases which survive for some weeks it is not uncommon to find alterations which we recognize as those typical of glomerulonephritis in the chronic or subacute phase. There are fibrotic and fibrosing glomeruli, there may be some glomerular crescents, there may be scars representing the sites of destroyed nephrons. Eventual renal failure with hypertension may supervene. Even in this pure type of tubular damage there is, then, glomerular injury. A reasonable deduction from this is that the tubules cannot be affected by any noxious agent without the glomeruli being involved. This is the point which has been stressed by Blackman, with especial reference to the so-called "nephrosis". The original description of this condition did not specify that there were no red blood cells in the urine to signify glomerular damage; it said only that the red cells were few. In the autopsy cases of the human disease it has been possible to demonstrate glomerular damage and, in nephrosis produced by pneumococcal autolysates in the experimental animal similar features are found, with the disease progressing to true chronic nephritis when the damage is continued.

2. *Bacteria and their products,* toxins and autolysates, have long been used to produce experimental glomerulonephritis. Various degrees of damage have resulted, but there is some argument as to whether the process is to be compared to the human disease when the renal injury is produced by the direct action of the foreign substances, or is of the nature of an allergic reaction. Considerable evidence has accumulated in favour of both of these suggestions, but from our point of view the useful conclusion is that experimental renal disease, like Bright's disease, can be produced by the injection of bacteria and their products into suitable experimental animals.

Reviewing the various clinical forms of nephritis, we can see types which commence with the onset of the causal infection, types which have an apparent incubation period comparable to that of human serum disease, and, finally, types which appear only late in the course of an acute or chronic infection such as endocarditis. All of these varieties of nephritis may be acute or show acute features, and the experimental value of repeating every type and sub-type is open to question. The conclusion seems to be that infection appears to have a causal relationship to nephritis.

3. Lindeman,[2] in 1900, was the first to produce renal damage by the use of organ-specific sera. Since then, various workers have repeated these studies in rats, rabbits, and dogs. Non-specific effects due to hæmolysis were responsible for some of the findings originally described as nephritis, but subsequent work has separated the true nephro-toxic nephritis from this form of injury.

Detailed studies, especially by Smadel[3] and his co-workers, have furnished a fairly complete investigation of this disease in rats. In the rat, however, there is no hæmaturia in the acute phase unless massive doses of nephrotoxin are given. The other features of acute and chronic nephrotoxic nephritis correspond fairly well with glomerulonephritis in the human subject.

In rabbits nephrotoxic nephritis is very similar to that found in the human subject, being marked in the acute phase by oliguria, albuminuria with casts, hæmaturia, œdema and rising blood urea. In the dog, however, polyuria was found in place of oliguria, œdema appeared in only a proportion of the animals, the plasma protein did not fall and there was no increase in the blood pressure.

Page and his associates,[5] who worked on the dog, take the reasonable attitude that these variations suggest only species variability and possibly some difference in the potency of the

sera utilized. Perhaps with the anthropoid apes a disease more comparable with Bright's disease might be produced with suitable sera. The conclusion to be drawn from these studies is that in various species a type of renal damage may be produced which is comparable in the sum of its features with human glomerulonephritis.

RENAL ISCHÆMIA AS THE CAUSE OF HYPERTENSION

Prior to 1928 there was no successful production of persistent hypertension despite the number of manœuvres and operations to which the kidneys in various species of experimental animals were subjected. Partial and total nephrectomy, unilateral or bilateral, either operative or by destruction of the renal tissue *in situ*, and many alterations of the blood supply or venous drainage were among the different procedures attempted without success. It is to be admitted that most of these efforts were acute experiments; they have been tabulated by Goldblatt,[6] to whose article reference is made.

Upon the basis that the end-result of the arteriolar alterations seen in hypertesion is an ischæmia of the kidney tissue, Goldblatt devised a clamp which could be manipulated to produce various degrees of constriction of the renal artery. Hypertension could be produced by this means, but the duration differed according to whether one renal artery was compressed or both renal arteries were narrowed. When one renal artery is constricted in the dog or monkey an elevation of the blood pressure immediately results, but this passes off in time, usually within a month. When both arteries are constricted, either at the same time or with an interval between the clampings, there is a persistent elevation of the blood pressure. If one kidney is removed and the renal artery of the other is compressed, the hypertension so produced lasts as long as the clamp remains in the vessel. The transplantation of the kidney to the neck, followed by narrowing of its artery by the clamp, produces an elevated blood pressure. Compression of the aorta above the renal arteries' origin produces hypertension, but this does not follow if the aorta is clamped below the origin of these arteries, nor does narrowing of any other artery appear to elevate the blood pressure.

Considerable investigation has been directed towards the problem of the bases and necessary conditions upon which renal ischæmia causes hypertension. All that can be said at present is that ischæmia of the kidney tissue produces a substance in the kidney which affects the peripheral circulation, with the end-result of raising the systemic blood pressure. There is recent evidence suggesting the necessity for some local tissue substance to be acted upon by the blood from the ischæmic kidney, but this needs further elucidation.

The suggestion of the elaboration by the ischæmic kidney of some substance raising the blood pressure, goes back to the demonstration long ago by Tigerstadt and Bergmann that a saline extract of rabbit kidneys had the effect of raising the blood pressure of rabbits into which it was injected. This substance has been called renin and considerable effort is being made to link the substance elaborated by the Goldblatt kidney to it. An interesting feature of the response to renin is that a refractoriness is developed to it in a series of injections, there being finally no elevation of the blood pressure, but it might be interesting to place a Goldblatt clamp on an animal made refractory to renin. The findings of Goldblatt have been repeated in the rabbit and rat and comparable conditions have been reported in the human subject. The urologists have been especially active in the recognition of unilateral kidney disease associated with hypertension. Some of these have been cases of pyelonephritis limited to the one side; others are kidneys misplaced in which there was a degree of angulation or stretching of the renal artery, with a resulting ischæmia of the kidney tissue. The removal of the one diseased kidney has produced a most remarkable decrease in the elevated blood pressure.

In a series of autopsy cases, Blackman[1] was able to demonstrate that hypertension was associated with narrowing of the main renal artery or arteries by arteriosclerotic plaques. These cases correspond to the Goldblatt animal, as do numerous cases which one encounters in routine autopsies where there has been compression or stretching of the renal arteries. One recalls the compression of one renal artery by a saccular aneurysm of the aorta and another case in which an aberrant renal artery was stretched by a metastatic tumour deposit in a contiguous lymph node. It is not to be supposed that every case of hypertension is associated with renal ischæmia or even with renal disease. Common experience belies such a statement, for one has but to recall the importance of intracranial masses and the different adrenal tumours in the production of hypertension. It can be said, however, that most cases of hypertension are renal in origin and should be so considered until all methods of investigation have failed to confirm such an etiology or until other causes have appeared.

Another clinical link to the Goldblatt animal has appeared in the study of obstruction to the urinary outflow. In these cases in which the dilatation of the pelvis and calyces has developed, it is not uncommon to find an elevation of the blood pressure which responds dramatically to the relief of the obstruction and the resulting decompression. The hypertension in these cases may be presumed to be due to the compression of the branches of the renal artery by the dilated pelvis or calyces as these small vessels enter the kidney substance. In some of

the cases of so-called "essential" hypertension investigation shows some abnormality of the urinary passages, and we are coming more and more to an explanation of the etiology of the condition. There is still no histological basis for the development of hypertension in the presence of renal ischæmia, apart from one suggestion which will be discussed further on. Some studies have appeared describing negative findings in the ischæmia kidney; others, perhaps more careful, show changes described as specific.

PYELONEPHRITIS AS A TYPE OF BRIGHT'S DISEASE

We have used, especially in the discussion of the essential unity of renal damage, the terms "glomerulonephritis" and "Bright's disease" as almost interchangeable. That is in keeping with the usual conception of Bright's disease as a bilateral non-suppurative inflammatory disease of the kidney. It may terminate in renal failure; it is sometimes associated with hypertension. The other features, such as the rise in certain blood chemicals, etc., are too familiar to need repetition. Entering into our concept of Bright's disease is a group of renal injuries which in the later stages may be indistinguishable from chronic glomerulonephritis but which are in the beginning sometimes unilateral, sometimes, perhaps usually, suppurative and progressive, leading to renal failure and vascular lesions associated with hypertension. This new and important type of renal disease is pyelonephritis which Weiss and Parker[7] have but lately pointed out as important.

The significance of pyelonephritis is suggested in the fact that, in the experience of Weiss and Parker, healed and chronic pyelonephritis occurs more frequently than chronic glomerulonephritis. One group of contracted kidneys at autopsy, 55 in all, showed 27 to be caused by arteriolar nephrosclerosis, 18 by pyelonephritis, and 10 by glomerulonephritis. In the Boston City Hospital over a period of five years, there were 272 cases of pyelonephritis of various types and only 164 cases of glomerulonephritis over the same period. Several reasons are suggested by the Boston authors for the failure of recognition of pyelonephritis as an entity, chiefly its variable clinical course and structural lesions. The case seen by the pædiatrician as a pyelitis reappears as one of the toxæmias of pregnancy confronting the obstetrician; it is seen as a pyuria by the urological surgeon, and ends as a problem for the internist with hypertension of a severe degree, renal failure, and typical blood and urinary findings. In the latter phases there may be few indications of the original infectious process.

The usual types of inflammatory change are seen in pyelonephritis; there is an acute, a chronic and a healed stage. Recurrence may appear at any stage after the acute stage has resolved, and either kidney may be affected singly. When both kidneys are affected the degree of involvement and the age of the process may be different in the two kidneys. In the acute stages there are the findings which are considered to be those of pyelitis, fever, pallor, pain and tenderness in one or both kidney regions, dysuria, tenesmus and pyuria. There is usually no abnormality of the blood pressure or the nitrogen compounds of the blood. Although a certain proportion of the cases show some abnormality of the primary tract, others show such a lack of specific symptoms that the diagnosis is difficult.

It is important to realize that every case of pyelitis is a pyelonephritis, showing with few or no exceptions (according to the thoroughness of the histological examination) involvement of the renal parenchyma. The disease appears to be most common in the extremes of age and in pregnancy. The acute process must be considered as an inflammatory one of the interstitial substance of the kidney, perhaps also of the tissue spaces and the lymphatic channels. When the process is situated outside the nephrons for a considerable time the urine remains normal although the typical systemic and local findings of pyelonephritis are present. Eventually, pus appears in the urine and this represents the breaking of the infectious process into a channel communicating with the urinary tract.

The acute stage may be followed by complete recovery with resolution of the original process. Some cases, on the other hand, show pyuria and the presence of bacteria in the urine, sometimes for years. Whether or not systemic manifestations such as fever, dysuria, anæmia and final renal failure appear depends upon the virulence of the causative organism and the degree of involvement of the renal parenchyma. The important cases from our viewpoint are those which show, following an acute episode, only anorexia, pallor, lack of energy with obscure fever, and bouts of abdominal pain of several days' duration recurring at irregular intervals. Such cases may show no more than a few pus cells in the urine, but cultures of the urine over a period of time should show the causative organism. The urine may be alkaline and does not respond to the usual acidifying drugs. In either group there may be some elevation of the blood pressure and, although the heart is not usually enlarged, there may be some thickening of the peripheral blood vessels. Red blood cells can appear in the urine to the degree of frank hæmaturia, due to the rupture of minute blood channels into the pelvis. Anasarca is rare, but the concentrating and diluting powers of the kidney are impaired and the urea-clearance and phenolphthalein percentage are decreased. Cystoscopy and pyelography demonstrate at this stage quite frequently some cystitis and some abnormality of the calibre of the renal excretory passages. Most typical of all, x-ray

examination shows finger-like projections of the calyces into the renal parenchyma.

The course and termination of chronic pyelonephritis vary considerably. After moderate nitrogen retention of many years' duration, there may be a serious episode of renal failure, even to the point of uræmia with coma and pericarditis. Even these cases can recover and function satisfactorily for several years. The exitus is usually brought about by uræmia. In these cases in which hypertension is most marked death is rarely due to cerebrovascular accidents or cardiac complications.

The most difficult stage in pyelonephritis to diagnose is the healed stage. The history of pyuria with urinary infection gives one a lead; negative evidence is the absence of glomerulonephritis in the past history. Where one or more attacks of pyelonephritis are followed by a symptom-free period of years with eventual hypertension or uræmia, signs pointing to renal impairment should suggest the healed stage of pyelonephritis despite lack of evidence of renal infection. The inflammatory process has reached a progressive stage, the infection may have long disappeared, but the changes initiated by the infection have continued. Again, the infection may at any time recur.

An important histological finding in those cases of pyelonephritis associated with hypertension has been hyperplastic arteriosclerosis. This type of lesion of the arterioles, marked by the increase of the sub-intimal cells, is identical with a change which appears also in the so-called "primary" or "essential" hypertension. There is a proliferative endarteritis in both types of disease, but hypertension does not appear to develop in the absence of the special type of arteriolar change.

We may mention, to explain these cases in which a mechanical obstruction to the urinary outflow could not be demonstrated at the time of autopsy, that there may have been a failure to rule out some temporary, perhaps momentary, obstruction to the channel, of sufficient duration to initiate the infection by the resulting stasis.

A Mechanism for the Regulation of Glomerular Activity

One of the failures in the study of renal diseases seems to consist in the lack of exact histological information about the normal kidney, both human and animal. Within recent years the studies of Bell and his co-workers on the normal kidney have borne fruit in the description of "sub-clinical nephritis" which appears to represent the earliest stages of glomerulonephritis. In another similar type of study the work initiated by Ruyter[11] and that of Zimmerman[12] appear to give hope for a new histology of the normal and diseased kidney. Ruyter, in 1925, recognized afibrillar, granulated cells in the juxta-glomerular portion of the kidney of the mouse. These granules were best shown by the Altmann stain for mitochondria. In 1927 Oberling[10] found afibrillar cells in the human subject and similar cells have been seen in the afferent arteriole of the frog, the rabbit, and the cat (Edwards).

Adjoining the terminal portion of the afferent arteriole in the kidney of all the mammals examined by Zimmerman,[12] a specialized portion of the distal tubule was found. In this portion the cells of the tubule became columnar, the nuclei seemed aggregated together. This area has been given the name of the macula densa by Zimmerman. That this distal tubule-afferent arteriole relationship was not restricted to the mammals is apparent from the description of the structure in the bird and from our own demonstration of a corresponding structure in the frog. There is no aggregation of the nuclei of the tubules to form the macula densa in the frog, but in *R. pipiens* which was the subject of our studies, there is a distinct tinctorial difference between the proximal and distal tubule, and in suitable sections the distal tubule may be seen applied to the afferent arteriole.

It was presumed by Goormaghtigh[8] that the macula densa in the human is a portion of the nephron supplied by the afferent arteriole, forming with it the juxta-glomerular complex. Oliver has demonstrated that the distal tubule in the nephron forms a meshwork about the glomerulus and, since it was possible to demonstrate the continuation of the tubule forming the macula densa to an arborization about the glomerulus, I thought it was reasonable to presume that the tubule did actually form part of the nephron continuous with the juxta-glomerular complex. The complex formed by the macula densa (or segment of the distal tubule) and the afibrillar cells of the afferent arteriole is so situated strategically that some important function can well be assumed for it. In a comparative review of the physiology of the kidney it seemed that such a complex could not be concerned in the excretion of urea, uric acid, chloride or sugar, nor in the dilution or concentration of the urine. Several other possible functions were considered, but it appeared most probable, upon the basis of comparative physiology, that this structure was responsible for the periodicity of blood flow through the glomerulus. The afibrillar cells of the afferent arteriole have been a particular subject of study by Goormaghtigh. The location of these cells is not restricted to the juxta-glomerular segment of the afferent arteriole in the mammals, but they are found also in the other portions of the afferent arteriole and in the interlobular artery, lying immediately beneath the endothelium. Goormaghtigh has described selective damage to the fibrillar cells in scarlet fever with sparing of the afibrillar cells. In the dog, fed with massive doses of vitamin D and made hypertensive, there is a similar reaction with damage to the fibrillar cells and an increase in the number

of the afibrillar cells. Goormaghtigh has described similar hyperplasia of the afibrillar cells of the Goldblatt dog and in the rabbit made hypertensive by the Drury technique. This latter finding has been confirmed by Dunihue and his colleagues.

Upon the basis of the association of hypertension and hyperplasia of the afibrillar cells Goormaghtigh has postulated that these cells produce the hypertensive substance. In further support of this theory he has described the occurrence in the afibrillar cells of granules which are said to pass through a cycle of activity corresponding to that of the cells of the anterior pituitary. These cells are likened by Goormaghtigh to an endocrine gland in the wall of the renal arteriole, producing hypertension when they become hyperplastic.

It must be admitted that the concept of the juxta-glomerular apparatus furnishes a new and welcome approach to the study of the diseases of the kidney. Entirely apart from the study of hypertension, a basis for the regulation of urinary output is a welcome addition to histology and to pathology. In a brief survey of some autopsy material it seemed to me that there was, fairly uniformly, involvement of all or part of these elements of the juxta-glomerular complex in those cases of subacute or chronic nephritis in which there was failure to concentrate the urine. This is, as far as I am aware, the only study of the juxta-glomerular complex in nephritis.

Some of the hesitancy in acceptance of this line of work of Ruyter, Zimmerman and, especially, Goormaghtigh, has been due to the difficulty with which these new structures are recognized. There should be no difficulty in making out the macula densa, nor will there be if the original description of aggregation of nuclei in the wall of the distal tubule is remembered. The granules described in the afibrillar cells in certain species can be demonstrated with stains for mitochondria. In other species special stains must be devised, in the cat the granules in the special cells show up best with a heavy eosin stain followed by the usual Masson stain. Goormaghtigh has described his own technique in some length. Such secretory activity as that suggested for the afibrillar cells by Goormaghtigh would certainly be unusual in cells of the mesoblastic origin of the arterioles. If these cells do liberate a substance essential for the maintenance of normal blood pressure, why no fall of blood pressure after bilateral nephrectomy, unless the substance liberated is stable and lasts for some while after its production is discontinued? If this is true, the elevation of blood pressure in the Goldblatt animal should persist for a corresponding period after the release of the clamp. I am not aware of any studies of this sort.

DISCUSSION

The first fact that seems to arise from these studies is that our old concept of Bright's disease needs some enlargement. The older view was that of a progressive renal disease ending in functional failure, sometimes associated with hypertension and with the added features of both kidneys being involved, and the non-organismal nature of the process. This view was due to incomplete observation. Some of the cases originally described by Bright might have been pyelonephritis. If we take the viewpoint that Bright's disease includes any type of progressive renal disease, a much more logical conception appears.

The entity of glomerulonephritis remains, if somewhat diminished in importance, and now somewhat overshadowed by pyelonephritis. By glomerulonephritis we mean now the reaction of kidney to damage and there is no longer any reasonable basis for elaborate classifications and terminologies. The etiology is quite as varied as the different pathological pictures and both have in common the factor of injury to the kidney and the healing reaction of the kidney tissue. Apparently, this healing reaction is not always harmless. In pyelonephritis and in glomerulonephritis there seems to be scarring to the extent that the blood supply to the tissue is diminished and ischæmia results. This, as the experimental work of Goldblatt has shown, may be the basis for the development of hypertension. When the cellular background for this hypertension is sought we are on less sure ground. It may prove true that the hyperplasia of the afibrillar cells described by Goormaghtigh is the basis for the development of hypertension. It is recalled that the afibrillar cells were described as being present in the sub-endothelial intima in the renal arterioles and that hyperplasia of these cells, in just this situation, would produce a picture like that described and depicted by Weiss and Parker in their studies of pyelonephritis. These authors mentioned that the hyperplastic arteriolosclerosis of that kind was seen (1) only in those cases of pyelonephritis associated with hypertension and (2) in the malignant nephrosclerosis of essential hypertension. We have seen exactly the same hyperplasia of sub-endothelial intimal cells in the arterioles in kidneys from cases of glomerulonephritis although it is quite as common to find in this group of cases proliferation of arteriolar cells in the other situation of the afibrillar cells, *i.e.*, at the afferent arteriole in its juxta-glomerular portion.

The determination of the exact nature of these cells, and the separation of their changes upon the basis of cause and effect, will be an interesting field for research. It may be found that certain essential substances are necessary for nutrition of the various portions of the nephron and arterioles, and that deficiencies are followed by pathological lesions. Some defici-

ency, or toxic disorder, may well be the basis for the production of the malignant type of hypertension, for it now appears possible that this disease is renal in origin and may originate in a disorder or increased secretion of one type of cell.

The whole experimental field in kidney disease and even in renal physiology has, at any rate, received a strong stimulation from the description of the juxta-glomerular complex and the afibrillar cells. Past experiments are valueless when not done in terms of this structure and the whole field of study of the kidney, normal and diseased, seems defective, awaiting the beginning of a new type of research.

ADDENDUM

Friedman (1942) has shown the absence of renin from the aglomerular kidney of the midshipman fish and its presence in the glomerular kidney of the dogfish and carp. This seems to indicate that renin is elaborated in the glomerulus or in the glomerular vessels, which conclusion is of interest in the light of the work of Goormaghtigh.

BIBLIOGRAPHY

1. BLACKMAN, S. S.: *Bull. Johns Hopkins Hosp.*, 1935, 57: 70.
2. LINDEMAN, W.: *Ann. Inst. Pasteur*, 1900, 14: 49.
3. SMADEL, J. E.: *Am. J. Path.*, 1939, 15: 199.
4. EHRICH, W. B. *et al.*: *J. Exp. Med.*, 1938, 67: 769.
5. PAGE, I. H. *et al.*: *Am. J. M. Sc.*, 1941, 201: 313.
6. GOLDBLATT, H.: *Bull. N.Y. Acad. Med.*, 1938, 14: 523.
7. WEISS AND PARKER: *Medicine*, 1937, 18: 221.
8. GOORMAGHTIGH, N.: *Arch. de Biol.*, 1940, 51: 293.
9. DUNIHUE, F. W. AND CANDON, B. H.: *Arch. Path.*, 1940, 29: 777.
10. OBERLING, C.: *Compt. Rend. Acad. Sci.*, Paris, 1927, 184: 1200.
11. RUYTER, J. N. C.: *Zeitschr. f. Zellforsch. u. m. a.*, 1925, 2: 242.
12. ZIMMERMANN, K. W.: *Zeitschr. f. mikro-anat. Forsch.*, 1933, 32: 176.
13. FRIEDMAN AND KAPLAN: *J. Exp. Med.*, 1942, 75: 127.

Men and Books

OLD AND EMPIRICAL REMEDIES

BY K. A. BAIRD, M.D.

West Saint John, N.B.

Science in general has passed through a stage of dogmatism and of "cock-sureness". During that stage it was the popular attitude, particularly for the lesser minds in science, to consider that everything that was not a very recent discovery was probably wrong, that the so-called laws of science were inviolable, that the only way by which knowledge could be acquired was by laboratory experiment, and that knowledge thus acquired was definitely more accurate than that acquired in any other way. Fortunately, the trend in the physical sciences during the last quarter of a century has been to get away from this dogmatic attitude and to assume what might be called the questioning attitude. The really great scientists of today not only do not think that they know everything but assume that it is impossible for them to reach ultimate truths because truth is by its very nature expanding like the universe.

What has all this to do with medicine? The answer would seem to be that the profession is still rather behind the physical sciences, in that we are closing our minds to much truth, and near truths which do not come to us through certain accustomed channels. It is quite true that as little as a generation ago the art of medicine was still being practised on a basis of many wrong hypotheses and unverified "knowledge" so-called.

With the more modern way of acquiring evidence through the use of the method of controls, based very largely upon the influence of the laboratory worker, it soon became a common practice to sneer at all old and empirical remedies which were not made on the basis of laboratory experiments. This brief article is intended to call attention to the fact that the practice of medicine is not a science but is still an art based on scientific knowledge, and that while making the fullest possible use of all that scientific knowledge can provide there still is and always will be opportunity for the wise use of methods of diagnosis and treatment of an empirical nature. Dr. Alexis Carrel, in his "Man the Unknown", makes the statement that there are other ways of acquiring knowledge besides observation and deductions therefrom, giving as an example the fact that an experienced physician sometimes knows what is the matter with his patient without being able to "prove" the diagnosis by mechanical or laboratory procedures, and this knowledge may be sufficiently assured to form a basis for treatment when by waiting for the slower and supposedly scientific method of diagnosis it may be too late to treat the case successfully.

It is not *scientific* today to blind ourselves to any source of helpful knowledge. To the really scientific mind we no longer *prove* things, we simply make them seem *probable* on the basis of our present knowledge. The department of medicine in which these ideas are well illustrated is that of treatment. There are many bits of empirical knowledge from all over the world. Slower *scientific* methods are gradually showing the reasons and in some cases making them more effective. The following is a brief account of a very few of these which the writer has noted in the course of a number of years. There are dozens of others and if we would experiment and find what is behind many of the old and empirical remedies it is quite possible we would make a number of very useful advances in the treatment of diseases.

It is of interest to note that various preparations of Ma Huang were used in China for

centuries before the alkaloid ephedrine was isolated a few years ago. The discovery of the essential principle has made possible a much more accurate and intelligent use of the drug. Can there be any reasonable doubt that the Chinese "had something" for which we clever *scientists* of the West had no equivalent?

The liver of the cod was employed for centuries as a household remedy by fisherfolk of Norway, Greenland, and Scotland. It was first used by physicians in England in 1785. The discovery of vitamins has enabled us to be more intelligent both as to the indications for and use of preparations from the cod liver, and in regard to the results we are entitled to expect from its use. But it ill-behoves anyone to sneer at the value of the empirical use formerly made of this remedy.

During the years the writer spent in China he was often driven to wonder whether or not the needling practised by the Chinese was a relic of knowledge possessed by earlier surgeons of the value of draining abscesses, a knowledge which had become obscure through the years until it was, in part at least, a matter of superstition. The practice was probably not so dangerous when the needles were heated as was often done, but the use of cold needles was frequently followed by fatal cases of cellulitis and peritonitis.

Many centuries ago Rufus of Ephesus advocated that fever should not only not be combated but it could only be wished that in some way fever could be artificially induced, because it is a great remedy. Rufus of Ephesus came to Rome during the reign of Trajan (98-117 A.D.). As late as 1800 years later doctors as well as the laity were fighting against fever as though it was the disease. It is only recently that it is being realized that an elevation of temperature is not only a symptom of invasion of the body by an infection, but is one of the devices of nature to discourage the living offenders. Unless the temperature in itself is sufficiently high to cause injury it is considered by many that it should be left high and treatment should be directed towards the destruction of the invading organism. Indeed in some cases the wish of Rufus has been realized and fever is being artificially produced, as well as being stimulated, by infection with malaria. One wonders how many times in the intervening 18 centuries wise modern "scientific" doctors have laughed at the theories of Rufus of Ephesus and his empirical knowledge.

Some 4,000 years ago the Chinese are reported to have treated goitre by the internal administration of the ash of burned sea sponges. The ancient Greeks also used this medicine. The treatment was empirical and the existence of iodine was unknown. Today we are able to rationalize the knowledge of the ancients.

Soap and sugar have long been used by the laity as an application for boils and the practice has been sneered at many times by many physisians, famous and otherwise. Sir Almroth Wright first explained this treatment, pointing out that concentrated sugar is a surface irritant and hypertonic. It calls forth a rush of fluid when the horny layer of the skin is broken. The soap decalcifies the fluid and prevents clots and damming back of the discharge.

Speaking of boils, I remember as a small boy seeing older people taking the following prescription to put a stop to recurring crops of boils. "Throw a handful of gun shot into a tin cup. Fill the cup with milk and boil it for a time. Keep it on the back of the stove and take a sip three or four times a day." During the early days of my medical training and practice, which were incidentally still in the day of dogmatic science, I used to sometimes wonder what on earth those old folk thought they were accomplishing. Today a good many of the profession are prescribing tin in tablet form to prevent staphylococcus skin infection; and we are told that the discovery of this specific effect of tin was made by noticing that the worker in tin mines was pretty much immune from such infections.

I was told a few years ago by a man who sailed the seven seas in sailing ships, of a treatment frequently used by sailors in those days for what were called "salt water sores". These sores occurred on the feet. In the warmer climates at least, the men of course went barefooted. The treatment mentioned was to keep a pot of urine on the deck and dip the feet in it occasionally. At the first impulse one is inclined to consider this both crude and disgusting, as well as useless. However, the captain assured me that it produced beneficial results. After all, unless it is infected, what is urine but an aqueous solution of various salts including urates? And anyone who reads medical and surgical journals today is aware that urea is used a great deal in the treatment of wounds and is considered to have certain valuable properties in stimulating the growth of cells. In other words, while it may be more æsthetic as well as possibly more efficient, to buy our urea as a powder in a bottle, it is nevertheless quite possible that the empirical remedy used by the sailors was sufficient to save them a great deal of agony from the "salt water sores".

Another version of this same mode of treatment occurs in a note describing sympathetic powder and salve which were famous in the seventeenth century. The chief ingredients of the ointment seem to have been moss from dead men's skulls, men's blood, and linseed oil. Salmon writes about the use of the ointment (about 1693), and the following quotation gives a hint that the cure may have been fairly effective although it has very little relation to the salve. "If the weapon wounding, or anything dipped in the Blood be dressed with it, it will cure the Wound, though the patient be never

so far away; dip the weapon into the ointment and leave it so, the Patient in the morning *washing the Wound in his own Water,* and without adding anything else, tie it up warm and carefully, and the Patient will be cured without pain." Further illustrations of this empirical knowledge of the now acknowledged value of urea to the health and well being of epithelial cells can be seen in a practice about which the writer used to hear a good many years ago. It was said that it was the custom of many women who took care of small babies to wipe their own cheeks with the wet napkin, the idea being that it would give them a beautiful complexion, and it was further reported that these same women did have beautiful complexions! Jenner's great discovery of vaccination was similarly based on the empirical knowledge of crude and ignorant people who had to do with cows.

This brief article by no means exhausts the list of examples of the values underlying empirical and sometimes very crude treatments. The reader can doubtless think of others himself. In some cases they may have real value which is being denied the world because no one who knows about them has thought it worthwhile to look for the alkaloid in the herb, the urea in the urine, the tin in the cup, or the immunity conferred by the cow pox. Arthur Whitfield, of London, says, "It is my experience that most advances in treatment have begun empirically and their mode of action explained later." The purpose of writing this article is that it may possibly serve as an incentive to act more along the lines of Whitfield's suggestion, considering that it ill-behoves us to sneer at any treatment however crude as long as it gives results.

CATECHISM IN MEDICAL HISTORY

By Heber C. Jamieson

Edmonton

Questions

1. Who were the founders of microscopy?
2. What was the name of the fictional nurse made famous by Dickens?
3. A woman was Inspector General of the military hospitals in Canada and later Inspector General of all the British Hospitals. Who was she?
4. Where was the first hospital in Canada established and when?
5. What is meant by the Doctrine of Signatures?

Answers

1. (1) Robert Hooke (1635-1703), an Englishman. In 1665 he described the structure of cork; introduced the term "cell". This was the beginning of the Cell Theory on which the whole of modern biology rests.

   (2) Nehemiah Grew (1641-1712), an Englishman, who in 1682 published a book, "The Anatomy of Plants".

   (3) Marcello Malpighi (1628-1694), an Italian. In 1661 he described the capillaries, thus completing the work of Harvey who had left this one link in the circulatory system unexplained. His name is also perpetuated in the Malpighian layer of the skin, the Malpighian corpuscles of the spleen and the Malpighian pyramids of the kidney.

   (4) Anthony van Leeuwenhoek (1632-1723), a Hollander. He first saw bacteria and protozoa. He *saw* red corpuscles passing through the capillaries. A pupil of his discovered spermatozoa.

   (5) Jan Swammerdam (1637-1680), another Hollander, discovered the red blood cell, and wrote on the minute anatomy of insects.
2. Sairey Gamp in "Martin Chuzzlewit". She was ignorant, dirty and loved her grog.
3. Dr. James Miranda Stuart Barry. She served forty-six years in the British Army without her sex being discovered. A graduate of Edinburgh in 1812, she was staff-surgeon at the Cape of Good Hope, was stationed at Jamaica and at St. Helena and served in the Crimean war. In 1857 was with the army in Canada. She fought two duels, one of which was said to have ended fatally for her adversary. Barely five feet tall, she carried the longest sword and wore the biggest spurs she could find. This was one of the most remarkable cases of sex impersonation on record.
4. At Quebec. In 1639 three Ursuline nuns arrived from France and in tents cared for the sick. Soon a building was erected and called the Hôtel-Dieu.
5. A belief prevalent in the middle ages that the Almighty had placed His signature on plants for the guidance of man in treating human ailments. The shell of the walnut had the configuration of the skull, and was therefore to be used in diseases of the cranium.

Medical War Relief Fund

Medical War Relief Fund

Additional subscriptions have been received from:

British Columbia Division	$120.00
Individual subscriptions from Saskatchewan	60.00
North Eastern Saskatchewan District Medical Society	74.00
Brant County Medical Association	50.00

The General Secretary's Page

I have just completed a review of close upon 5,000 war survey questionnaires which the medical profession answered some months ago. I wish it were possible for all our members to study these returns with the nomination cards from the Divisions attached thereto. I imagine Mr. Gallup could write quite an arresting story about them, interwoven with interesting statistics and observations. But I am not Mr. Gallup and, even if I were, there are some observations which will keep for another season.

In studying the cards, one noticeable fact is observed over and over again, namely, that old soldiers never die. In fact in the whole survey nothing stands out more prominently. You will recall the questions:

> "Are you prepared to enlist as a medical officer in His Majesty's Service? — "When"?

This is how a young 74-year old veteran of the last war answered:

> "You bet I am".
> When? — "As soon as I can get my boots on."

And another veteran:

> "Try me and see. I'll be on deck before the blinking bugle blows."

Yes, old soldiers never die; they just fade out.

But we are told that this is a young men's war; and may I say to all who volunteered to enlist, that your offer has been carefully examined by the Divisional Advisory Committee in your home Province and, if you have not been called upon to enter military service, please realize that the Committee has used its best judgment with regard to you and the work in which you are now engaged, in recommending that you stay where you are. However, to every doctor who may feel that he has not received a satisfactory reply from the Canadian Medical Procurement and Assignment Board or the Divisional Advisory Committee, may I suggest that you contact the Committee or write directly to me at Ottawa and you will be answered promptly.

There is a wide gap in this survey, to which reference should be made. It is estimated that upwards of 3,000 doctors still in civilian life did not take the trouble to answer the questionnaire and we have no way of knowing what their wishes are with respect to military service. Before this page is read, a nation-wide survey in the health field may be under way, including medical, hospital, dental and allied health services. It is anticipated that in this study all persons in the professional services will be contacted in order that there may be no doubt as to what part each wishes to play in this war. No one will deny the necessity of such a complete stock-taking as we go further and deeper into an all-out war effort. When it is known exactly what is available in the way of personnel for the various needs, military and civilian, it will be easier to plan and chart our course.

The Canadian Medical Association, as an integral part of the Canadian Medical Procurement and Assignment Board, has undertaken a most important task. To us has been given the responsibility and privilege not only to put our own house in order but to direct in a very large measure our war efforts. It would be well to remember that this is a compliment and a challenge. When the war is won, other opportunities of equal importance, and we trust of much longer duration, may be entrusted to the medical profession. This surely is our hour not only to do our duty but to serve our country and ourselves well.

Our membership for the year about to close stands at 6,606, including 1,540 in military service. This represents 77.3 % of the English speaking medical profession, and 62.5% of the total medical population of Canada. It is most gratifying, indeed, to be able to report that this is the highest membership in our history, being a gain of 1,944 over the previous year. But, it is not good enough. We cannot afford to relax in our efforts until every eligible Canadian Doctor is a member of the Canadian Medical Association.

I hear someone say, "Why keep harping away on that 100% membership song"?

Personally, I offer no apologies. The activities of the Association are of much importance to every doctor in Canada; and, conversely, every doctor has something of equal importance to offer the Association, namely, his allegiance which, along with that of all his professional brethren, can carry medicine to a high plane in the community and keep it there no matter what efforts may be advanced from other quarters to tear it down. I venture to prophesy that the next five years will be the most critical in the history of Canadian medicine. That changes are coming, we need have no doubt; we have received ample warning. We know that health insurance legislation is in the making. Post-war reconstruction will unquestionably present many problems demanding most careful consideration at the hands of a united medical profession. A word to the wise is sufficient. One sometimes wonders.

Within the next few weeks, the Divisions will be calling upon members for their 1943 annual dues. May 1943 find us stronger than 1942, and may those of us who remain at home demonstrate to our colleagues who are serving in other lands that the Association is vitally alive.

Hospital Service Department Notes

Hospitals in Ontario Consider War Situation

Current problems facing hospitals and their staffs were the centre of interest at the three-day Wartime Conference of the Ontario Hospital Association in Toronto at the end of October. A record attendance of over 700 revealed the concern which hospitals are feeling at the present time over their shortage of staff, difficulty in obtaining equipment, over-crowding and the necessity of preparing for emergencies. Some forty-eight speakers were on the program. One session was devoted to air-raid precautions, organization for medical and surgical emergencies, gas attacks and the provision of auxiliary power. In a symposium on "Hospital Administration in Wartime", various authorities dealt with the shortage of surgical and drug supplies, the personnel shortage, dietary difficulties, maintenance of intern services and problems in general.

Health insurance, as it would apply to hospital work, was analyzed from the angle of the hospital, the medical profession and the nurses, the delegates being brought up to date with present developments at Ottawa. Much discussion took place also with respect to the Ontario Plan for Hospital Care which, at the time of the meeting, had a coverage of over 120,000.

The work of the nurses received much consideration, there being addresses and discussions on qualifications, postgraduate training, prevention of infections and the utilization of selected graduate nurses to perform certain clinical duties, such as intravenous administration, etc. Blood storage and blood banks, child problems in wartime, war plant nutrition and many other topics appear on the program.

Guest speakers from outside the province were: Dr. G. F. Stephens from Montreal, President of the Canadian Hospital Council, who spoke on health insurance; Dr. M. T. MacEachern, Associate Director of the American College of Surgeons, who participated in many sessions as well as giving a luncheon address; and Mr. James A. Hamilton, New Haven, Connecticut, President of the American Hospital Association, who gave an eloquent banquet address. The excellent program was directed by President J. Clark Keith of Windsor and Dr. Fred W. Routley, Secretary. Mr. E. A. Horton of St. Thomas succeeded to the Presidency and Miss E. M. McKee of Brantford was named President-elect.

Associated with this convention were the meetings of the Ontario Conference of the Catholic Hospital Association, the Women's Hospital Aids Association, the Canadian Association of Medical Record Librarians, and the Medical Social Workers Association of Ontario.

All communications intended for the Department of Hospital Service of the Canadian Medical Association should be addressed to Dr. Harvey Agnew, 184 College Street, Toronto.

Medical Societies

Number 5 Canadian General Hospital, R.C.A.M.C.

The various Canadian hospitals overseas have been holding inter-hospital clinical days once a month for the last two years.

No. 5 Canadian General Hospital, R.C.A.M.C., was host and conducted a clinical day on Friday, August 28, 1942. The meeting was attended by Colonel L. C. Montgomery, M.C., V.D., Consultant in Medicine, Colonel J. A. MacFarlane, Consultant in Surgery, and Colonel F. H. Van Nostrand, Consultant in Neuropsychiatry, and a number of other officers from Canadian Military Headquarters. In addition, some 60 senior officers were present, including specialists from the other Canadian General Hospitals and Casualty Clearing Stations.

Below is given a program of the day, with abstracts from the various papers which were presented.

SURGICAL DIVISION

1030 hrs. VARICOSE VEINS IN THE SOLDIER.—Major C. W. Clark, R.C.A.M.C.

Three hundred and seventy-five ligations and retrograde injections, done on 231 patients, were reviewed. The results were very satisfactory, and only one patient in six required one or two post-operative injections to complete sclerosis. The only complications were: one case of minor pulmonary embolism; one case of severe anaphylaxis with œdema of the leg, urticaria and asthma, relieved by adrenalin. The œdema subsided in six weeks; transient phlebitis. This occurred in two cases about 3 months after operation; œdema in one case, with old ulcers and extensive scarring, persisted after ligation.

The following points were brought out: (*a*) Perthe's test, if taken to indicate deep venous obstruction, will deny treatment to those patients with small saphenous or incompetent communicating veins. (*b*) The Trendelenburg, and the three-tourniquet test of Achsner and Mahomer were emphasized. (*c*) Injection alone is only useful in localized varicosities with a negative Trendelenburg test. If the sapheno-femoral valve is incompetent injection only is useless for permanent cure. (*d*) High ligation, division, and retrograde injection of 6 to 8 c.c. of 5% sodium morrhuate is the most satisfactory treatment of great saphenous incompetence. The ligature should be above the lateral branches at the fossa ovalis. Three hundred cases of this type have been done. (*e*) Small saphenous varicosities are more common than supposed. Forty-one cases required ligation and retrograde injection in the popliteal area. Twenty cases of this type occurred unassociated with great saphenous incompetence. (*f*) Condylar, or low thigh, ligation and retrograde injection was performed 31 times. This is useful as an adjunct to groin ligation and in communicating types of incompetence. It is expected that a full report on this work will be published soon.

1100 hrs. RELATIONSHIP OF ANÆSTHETIST AND SURGEON.—Major A. St.C. Rumball, R.C.A.M.C.

The use of pre-operative medication, and the care of the patient following its administration were outlined. The desirability of gentle handling of tissues, and avoidance of sudden stretching of wounds, and traction on viscera, which may set up a series of undesirable reflexes, was pointed out. The choice of anæsthetic was briefly discussed, the points to guide one being: (1) the mental and physical state of the patient; (2) the proposed operation; (3) the technique of the surgeon; (4) the experience of the anæsthetist.

Both surgeon and anæsthetist are working for the welfare of the patient, and it is only through team work and a spirit of helpful co-operation that they will each do their best in this direction.

1130 hrs. FRACTURES OF LUMBO-DORSAL REGION. TREATMENT AND AFTER CARE. — Major L. D. Croll, R.C.A.M.C.

The following topics were discussed briefly: (1) Fractures of spinous processes. (2) Fractures of transverse processes. (3) *Vertebral body fractures*: (*a*) anterior types; (*b*) posterior, vertebral, compression or rupture; (*c*) vertical splits and/or comminution of vertebral body.

Under (*a*) was discussed the simple compression of varying degrees, and the simple "beak" fracture of the anterior superior border. The concomitant injuries sustained by the ligaments of the vertebral arches and spines, and the articular capsules were discussed along with the mechanics involved. Early recognition and early, adequate, reduction and immobilization were stressed. Along with the descriptions of (*b*) and (*c*) x-ray plates were shown, and cases of fracture in and out of plaster demonstrated; as well as the exercises used in the stage of immobilization and afterwards.

The complete treatment of non-displaced and displaced fractures of the vertebræ of the lumbo-dorsal area was discussed, with diagrams. Mention was made of the various manœuvres in reduction; stress was laid on the properly fitted plaster, on the early ambulation and need for exercises during treatment. The question of grafting in the early stage of the comminuted type was brought up.

These remarks were made in the light of experience in No. 5 Hospital.

1200 hrs. LT.-COLONEL R. W. RICHARDSON, R.C.A.M.C., closed the morning session of the Surgical Division with a round-table discussion of several military surgical disposal problems.

MEDICAL DIVISION

1030 hrs. RECENT ADVANCES IN DIAGNOSIS AND TREATMENT OF SCABIES. — Major S. A. Boyd, R.C.A.M.C., who recently returned from a week's work with Mellanby at the Sorby Institute.

Carefully controlled clinical and experimental studies in scabetic infestation in humans carried out by Mellanby, Johnson, Gordon, Seaton, and others have offered an entirely new view on the transmission, clinical course and treatment of scabies. It is now held that infection is transmitted by direct bodily contact, blankets and clothing playing a negligible rôle. Following the initial infestation, the acarus burrows and reproduces without any apparent effects upon its host. About six weeks from the onset the patient becomes sensitized and develops the characteristic papulo-follicular rash accompanied by itching as an allergic response. The parasitic death rate in reproduction is extremely high, and the normally infected case will harbour about ten mites only. Over half the burrows are usually located on the hands, wrists, and backs of the elbows, and the acarus may be fairly readily removed from its site at the end of the burrow. The most satisfactory form of therapy is benzyl benzoate emulsion, which has proved to effect complete cure with one or two applications. A preliminary bath is hygienic, but not essential.

It is important to realize that the allergic response may continue for some time following cure, and psychotherapy is often required to deal with persistence of the itching. The negligible rôle played by clothing in transmission of the infestation is of profound practical importance in the Army, and means that much valuable time and clothing can be saved.

1110 hrs. ACUTE RHEUMATISM AS AN R.C.A.M.C. PROBLEM.—Major H. Hethrington, R.C.A.M.C.

A preliminary survey was given of this condition as it affects the Canadian Army in England. The classification was first discussed. The diagnoses given to various types of this condition by hospital physicians are many. There has been no systematic approach to the problem of a uniform classification, each physician using the one he particularly prefers. The result is that records of this condition are valueless, since there is a multiplicity of diagnoses for the same condition. A plea was made for the universal use in overseas hospitals and the records office of the classification approved by the Department of Pensions and National Health in Canada.

A survey of records of hospitals and the Records Office shows that a small percentage of admissions to hospital are due to acute rheumatic conditions. In the first six months of 1942 the admissions to No. 5 Canadian General Hospital, R.C.A.M.C. were only 2% of all admissions. The figures from the other Canadian hospitals were similar. It was not considered that this condition constituted a great problem from the point of view of the hospital physicians. The non-articular types of rheumatism were rarely treated as in-patients, and were the particular problem of the consultation clinics and the R.M.O. It was believed that all cases of rheumatoid arthritis should be discharged as unfit for further military service; but that patients who recovered from acute rheumatic fever could be returned to duty.

1150 hrs. Lt.-Colonel C. H. A. Walton, R.C.A.M.C., presented observations which he had made on some unusual cases of ACUTE ULCERATIVE STOMATITIS, and a follow-up of cases seen since the last report published in *The Lancet*, August, 1941.

Classification and definition of ulcerative lesions of the mouth, and their etiology, were discussed. It was suggested that Vincent's organisms and the streptococci commonly found are secondary invaders and not etiological. The dramatic effect of blood transfusion was mentioned in the treatment of the very toxic cases. Members of the vitamin B group appeared to have no effect in the disease. This report will be published in due course.

JOINT SESSION

1415 hrs. The outstanding feature of the day was an illustrated lecture given to a joint meeting of the Medical and Surgical Divisions by Dr. John McMichael, Acting Chief of the Department of Medicine of the British Postgraduate Medical School, University of London. He gave us a very interesting account of his clinical research on INFECTIVE HEPATITIS, (catarrhal jaundice) with particular reference

to his work with biopsy material taken by liver puncture. As there is considerable infective hepatitis (catarrhal jaundice) in the Army, Dr. McMichael's paper was of particular interest.

1530 hrs. Lieut.-Colonel R. W. Richardson concluded the day's program by opening a discussion on the classification and management of casualties arriving in large numbers at a General Hospital.

At the conclusion of each paper, wide and profitable discussion took place. It is felt that these meetings are valuable not only for any significant or clinical interest they might have, but because they give an opportunity for the staffs of the various hospitals to meet and know each other, and to discuss their mutual problems.

In addition to the above mentioned monthly clinical days, this hospital holds staff rounds weekly, and the medical and surgical divisions conduct them alternately. Current cases of interest are presented, and special problems discussed. The meetings are generally attended by the Army Consultants, and are open to medical officers of all services, British and Canadian. We are very proud to welcome medical officers from outside the hospital, and particularly our colleagues from the R.A.M.C. and R.A.F. medical service. Our officers are also privileged to attend the weekly staff rounds at the Hammersmith Hospital (British Postgraduate Medical School), and at least two always take advantage of this excellent opportunity to see civil hospital practice.

The regular monthly meetings of the medical staff of the Princess Mary R.A.F. Hospital, Halton, are also open to our officers and several usually attend each meeting.

C. H. A. WALTON, LT.-COLONEL, R.C.A.M.C.,
O. i/c Division of Medicine, for O.C.,
No. 5 Canadian General Hospital, R.C.A.M.C.

La société médicale des hôpitaux universitaires de Québec

Une séance de cette Société eut lieu à l'Hôtel-Dieu de Quebec le 2 octobre 1942. Suivent les résumés des presentations scientifiques.

UN CAS DE RÉTRÉCISSEMENT DE L'ARTÈRE PULMONAIRE.—Docteur L. N. Larochelle.

Annette O., 20 ans, entre le 12 septembre 1942, dans le service de monsieur le professeur Jobin, parce qu'elle a des douleurs pré-cordiales et interscapulaires.

Elle a fait à l'âge de trois mois, une maladie infectieuse éruptive du type variolique, et à partir de cette époque, selon l'avis de la famille et de leur médecin, on la considère comme cardiaque.

Actuellement, elle vient consulter à l'hôpital pour de la dyspnée, palpitations, douleurs interscapulaires, précordialgies, et à ces signes s'ajoutent de la frilosité, cryesthésie, bourdonnements d'oreille et hémoptysies au printemps dernier.

A l'examen physique, cette jeune fille a le teint rougeviolacé et les lèvres bleutées. Cette cyanose s'accentue à l'effort et s'améliore au repos complet. Les doigts des mains et des pieds sont hippocratiques. A l'inspection de la région pré-cordiale, la pointe du cœur bat sur la ligne mammelonnaire, dans le 4e espace intercostal gauche, à 8 centimètres de la ligne médiane. A la percussion, on constate que la matité cardiague est élargie transversalement et déborde le bord sternal droit.

A l'auscultation, on a un souffle cardiaque intense qui siège à la base du cœur, dans le 2e espace intercostal près du sternum, et qui se propage vers la clavicule près du sternum. C'est un souffle systolique qui est accompagné d'un frémissement cataire systolique perçu à la base du cœur.

L'examen radiologique montre une voussure marquée au niveau de l'arc moyen, et une augmentation du volume du ventricule droit. L'électrocardiogramme met en évidence une prépondérance ventriculaire droite.

En continuant l'examen général, nous constatons que tous les autres systèmes sont normaux.

Le B.W. est négatif. Un examen de la crase sanguine montre une polyglobulie à 8,000,000 de globules rouges.

Le diagnostic a été celui d'un rétrécissement de l'artère pulmonaire.

STENOSE PYLORIQUE À LA SUITE D'INGESTION D'ACIDE SULFURIQUE.—Docteur Charles Vézina.

Un enfant de deux ans, à la suite d'ingestion d'acide sulfurique à 20%, présente des vomissements abondants dans lesquels se reconnaissent des aliments ingérés 24 et 36 heures auparavant.

La radiographie ne montre rien d'anormal du côté de l'œsophage, mais un estomac dilaté, avec liquide à jeûn et aucun transit pyloro-duodénal. L'enfant a maigri considérablement: il est en dénutrition. Après sérum et transfusion, il est opéré: sténose cicatricielle très serrée du pylore; l'intérieur de l'estomac semble normal; gastro-entérostomie postérieure. L'enfant se remonte très vite et laisse l'Hôpital 24 jours plus tard, mangeant tout ce qu'il voulait.

Nous croyons que cet acide sulfurique à 20% n'était pas assez concentré et n'a pas séjourné assez longtemps au niveau de l'œsophage pour y produire des lésions appréciables. D'un autre côté, le séjour prolongé dans l'estomac, milieu où l'acide sulfurique n'a pu être neutralisé, ajouté à un spasme du pylore pourrait expliquer la sténose consécutive.

ASPECTS CLINIQUES DU GLAUCÔME ESSENTIEL.—Docteur Jean Lacerte.

On nomme "glaucôme essentiel" cette hypertonie oculaire que ne relève pas de cicatrices du tractus uvéal, d'une désorganisation traumatique oculaire ou d'une tumeur intra-oculaire. C'est une maladie bien caractéristique de l'adolescent ou de l'adulte qui est ou devient presque toujours bilatérale.

Le glaucôme essentiel se présente sous deux formes bien différentes qui en font deux maladies distinctes. Le glaucôme aigu et le glaucôme simple.

Après avoir dit quelques mots du glaucôme aigu, l'auteur s'attaque au problème du glaucôme simple, lequel est une maladie insidieuse, sournoise, de longue durée mais qui conduit inévitablement à la cécité si le diagnostic n'est pas fait en temps.

S'il persiste encore dans la pathogénie du glaucôme des obscurités relatives à la sécrétion des liquides intra-oculaires, à l'équilibre de pressions du sang et du liquide intra-oculaire, un fait se dégage malgré tout de l'observation clinique: c'est que le glaucôme est lié à un état d'instabilité nerveuse, organique et psychique, à une diathèse. Il a les caractères d'une maladie essentielle. C'est pour le moins un syndrome dans lequel le symptôme principal est l'hypertension oculaire.

UN CAS D'OCCLUSION INTESTINALE PAR DES ASCARIS LOMBRICOIDES.—Docteur Jacques Turcot.

Occlusion intestinale durant depuis deux jours, chez une jeune fille de dix-huit ans. On pense à une péritonite d'origine appendiculaire. A l'opération, on trouve

un bouchon, formé par des ascaris agglomérés, qui obstrue l'iléon à vingt-quatre pouces du cæcum. Levée de l'obstacle. Guérison.

OSSIFICATION PLURICENTRIQUE.—Docteur A. Rosario Potvin et Docteur Robert Lessard.

L'ossification pluricentrique de certains os peut donner lieu à des interprétations difficiles ou erronées des radiographies. Quand il s'agit d'accidents de travail, les conclusions du radiologiste et du chirurgien doivent parfois tenir compte d'anomalies qui en imposent pour des fractures.

Les auteurs présentent une série de 5 cas de rotule bi ou tri-partite, anomalie que l'on die très rare. Quatre de ces patients avaient subi un traumatisme du genou et chez l'une d'eux, un des fragments avait été fracturé.

Les rotules multipartites ne sont qu'un cas local de processus identiques et de même pathogénie pouvant se rencontrer dans plusiers autres os.

Une séance de cette Société eut lieu à la Clinique Roy-Rousseau, le 16 octobre 1942. Suivent les résumés de présentations.

MÉTRAZOLTHÉRAPIE DANS LES SERVICES DE L'HÔPITAL ST-MICHEL-ARCHANGE ET LA CLINIQUE ROY-ROUSSEAU.—Dr L. Patry.

Depuis le mois de mai 1938 jusqu'à juillet 1942 1,190 malades ont été traités par les convulsions provoquées. Les pourcentages ont été préparés en tenant compte de chaque forme de maladie. Sur 440 cas de démence précoce, 55% ont été libérés. Dans la psychose maniaque dépressive, sur 415 malades traités, 83.1% ont été libérés. Dans les psychonévroses, il y a eu 65 libérations sur un total de 85 malades. Dans les autres formes sont comprises toutes les psychoses puerpérales, les confusions mentales, les psychoses des dégénérés. Sur 250 patients traités, 203 ont été libérés.

Ce traitement ne comporte aucun danger, institué en milieu hospitalier. Nous n'avons enregistré aucun accident mortel au cours de la crise. Il découle des résultats obtenus qu'un devoir s'impose d'appliquer cette thérapeutique dès le début des troubles mentaux afin d'augmenter les chances de guérison qui diminuent avec la durée de la maladie. Pour des raisons d'ordre pratique, nous avons substitué l'électricité au métrazol depuis juillet 1942.

L'ÉLECTRO-CHOC DANS LES MALADIES MENTALES.—Dr M. Samson.

La méthode la plus recente de thérapeutique des maladies mentales est celle qui emploie le courant alternatif ordinaire pour produire des convulsions. Les malades susceptibles de bénéficier de ce traitement doivent d'abord subir un examen médical complet ainsi que les examens radiographiques et biologiques nécessaires. La tuberculose active, une affection cardiaque ou rénale non compensée, une maladie infectieuse ainsi que tous les états fébriles sont les contre-indications les plus importantes. L'électrochoc présente de multiples avantages sur le métrazol. Il produit une amnésie complète pour le traitement. La convulsion est moins forte qu'avec le metrazol, les complications de fracture de la colonne sont moins nombreuses.

Les cent premiers malades que nous avons traités ont reçu 1,167 traitements. Sur ce nombre 32 étaient des déments précoces, 14 (43.7%) d'entre eux sont guéris ou ont été améliorés; 68 patients présentaient d'autres psychoses (psychose maniaque dépressive, mélancolie d'involution, psychonévrose); soixante (88%) peuvent être considérés comme guéris ou améliorés.

EPILEPSIE PARTIELLE SENSITIVE SYMPTÔMATIQUE D'UN ANGIOME CÉRÉBRAL.—Drs S. Caron et G. Desrochers.

Les auteurs présentent l'observation d'un jeune homme de 22 ans chez qui se produisent à des intervalles irréguliers, depuis 5 ans, des troubles dysesthésiques dans l'hémi-corps gauche. Ils qualifient ces troubles d'épilepsie sensitive partielle et leur attribuent la même valeur localisatrice qu'à des crises d'épilepsie jacksonnienne. Ils en déduisent l'existence d'une lésion localisée à la zône sensitive de l'écorce cérébrale du côté droit, ce qui est confirmé par l'examen radiologique et le patient est dirigé vers un service de neurochirurgie.

L'intervention révèle la présence d'un anéurysme cirsoide qui est cautérisé en partie au galvanocautère et le malade se rétablit après avoir présenté une hémiplégie transitoire. Les crises dysesthésiques ne se sont pas manifestées de nouveau trois esmaines après l'intervention.

En terminant, les auteurs discutent les données qui pourraient permettre de faire le diagnostic avant l'intervention chirurgicale.

EPILEPSIE, CARDIOPATHIE, ERYTHROCYTOSE ASSOCIÉES CHEZ LA MÊME PATIENTE.—Dr C. A. Painchaud.

Il s'agit d'une malade de 33 ans, supposée épileptique, qui fut admise à l'Hôpital pour des troubles de l'humeur et du caractère, et des fugues. Depuis trois ans elle présente des pertes de conscience dont la description fait suspecter l'épilepsie, qui est confirmée à l'Hôpital, par une crise typique de mal comitial. Au cours de l'examen somatique on découvre une cardiopathie ignorée de la patiente, (maladie mitrale complète) et on constat l'existence d'une polyglobulie située entre 7 et 8 millions de globules rouges.

L'auteur ne s'arrête pas à la discussion de la polyglobulie, qu'il considère réactionnelle et postérieure à la cardiopathie. Il s'arrête à l'association cardiopathie et épilepsie; il en est amené à décrire l'épilepsie cardiaque, et à la diviser en deux formes selon les conceptions modernes: l'épilepsie de la maladie de Stokes-Adam, et l'épilepsie de l'asystolie. Il montre l'intérêt qu'il y a à bien connaître ces formes d'épilepsie dites cardiaques, parce que très souvent le traitement de la cardiopathie en cours influence très favorablement l'épilepsie associée.

L'observation qu'il présente en est un exemple.

The Canadian Association of Occupational Therapy

The twelfth annual meeting of the Canadian Association of Occupational Therapy was held on November 7th, at the Royal York Hotel, Toronto.

Dr. Goldwin W. Howland, President of the Association was in the chair. The growth of this organization has been due to the untiring efforts of Dr. Howland. It was first organized during the last war period, to facilitate recovery of post-war disabilities by scientific remedial therapy. The work steadily developed, and now, again in war time, the therapists have been called upon to play their part in assisting in the treatment of military patients. The Saturday meeting was the largest ever held.

In the morning reports of committees were read, followed by a luncheon. Col. C. McMane, Superintendent of Christie Street Hospital and a Deputy Administrator for the Department of Pensions and National Health, and Dr. F. W. Routley, National Commissioner for the Red Cross of Canada, were guest speakers. Dr. McMane discussed the importance of occupational therapy in shortening the length of ill-

ness, and how it could be used in rehabilitation because everyone who can, must be established after this war—not a minority but the vast majority. This would depend to a large extent on the application of occupational therapy. Dr. Routley told the Association that the Red Cross Society was vitally interested and would like to see occupational therapists in the hospitals as soon as possible.

Dr. B. T. McGhie, Deputy Minister of Health for Ontario and Director of Hospital Services, in thanking the speakers, stated how valuable the work of the therapists was in peace time and the necessity of keeping at least a minimal staff for the civilian population as well as supplying the needs for military and other hospitals.

The Canadian Association has already, on request, sent eleven therapists to staff hospitals in England and Scotland. New Zealand, Hawaii, the United States, and Africa have also asked for Canadian workers.

The afternoon meeting, a round-table conference, was devoted to ways and means of meeting as rapidly and as efficiently as possible the many war time demands.

RUTH M. FRANKS

The Calgary Medical Society

A meeting of the Calgary Medical Society was held at the Junior Red Cross Hospital on November 9, 1942, when an interesting program was enjoyed. Dr. M. G. Cody, the Superintendent, reviewed the medical and surgical work of this very active institution during the past year. Here 55 children can be cared for. The Board of Management is considering the building of a new wing to accommodate fifty more young patients, as there is always a long waiting list of those seeking admission. Dr. E. R. Selby, D.S.O., presented a paper on "Chronic osteomyelitis" and Dr. Gordon Townsend demonstrated a Denis Browne splint for "club foot". He also showed a number of radiographic films of various orthopædic disabilities which have been treated in this hospital.

G. E. LEARMONTH

Correspondence

Medical Replacements

To the Editor:

There will be grave need of medical replacements unless an Order-in-Council is passed forbidding sickness, old age and death to medical practitioners; perhaps even then. According to present plans there will soon be 25% of our numbers in the armed forces. These on the whole are the younger, more vigorous men, who do not less than 30% of the work in peace time. They are now looking after less than 10% of the population: the selected 10% who ordinarily furnish less than 5% of the medical needy. Meanwhile civilian medical demands have greatly increased.

This means that the 75% of us who are left, the older ones, many of whom should be retiring, relaxing or at least restricting their work, are being forced to do at least 50% more than they have been doing. There will be many casualties from over-work. In some places general practice has become a form of slavery and the physician, like Wellington at Waterloo, is praying "either for night or Blucher". The public is just beginning to understand that there may have to be some rationing of medical services, and our legislators and educators must carefully consider the matter of replacements, both for the Forces and at home. (If health insurance is to come with its extra services and duties there is an added urgency. We know that the bill is being written and the Prime Minister has forecast its parliamentary adoption.)

Recently the Honourable Minister of Munitions has announced preparations to build *ten* more munitions factories, which will not begin to produce munitions until some time next year. Evidently it is not the official view that the war will be soon over. Yet according to the Press some very short-sighted statements have been made in official or semi-official quarters. One man suggested that men be chosen to study Medicine by competitive examination alone. Heaven help our country if it is to be guided by men who believe that the quality of the M.D. is to be judged by the entrance examinations! Even after four years' knowledge of the students and final examinations no medical school can boast that it was farsighted enough to give honours to all of those who would become its distinguished graduates, or that all its honour students have later attained prominence. Evidently the speaker had not heard the saucy quip that " 'A' men make the marks, 'B' men make the good doctors and the 'C' men make the money". Of course scholarship must have a leading place, but to this must be added personality, background and physical fitness.

Personality should mean stability, resourcefulness, perseverance and the possession of those ideals which lead to the highest form of medical service.

Background should be considered. Among other things, what is the heredity, group and familial? In a set examination alone, one of the hyphenated groups, unhampered by mental conflicts over patriotic duty, might temporarily "out-smart" those which form the backbone of the country. Familial tendencies give valuable information. Also it should not be forgotten that students from the city very rarely settle in the country.

Physical fitness.—One speaker advocated that no man in medical category "A" be allowed to

go to college. This is sheer goggle-eyed idiocy. On the contrary, a quota of "A" Canadians should be filled first. These are primarily to go into the field and replace losses and relieve those M.O.s who for any reason must return home. Later, many will become general practitioners. Surgeons, physicians and obstetricians should be fit; country general practitioners simply must be. It is true that occasionally low category men have overcome physical handicaps to fill important places, but these are rare and in very special fields. Men over 50 called out at 3 a.m. in a January blizzard to wade through snow-drifts, carrying obstetrical supplies, did not start practice as army rejects. Any official who proposes to try it should be taken from his nicely padded arm chair and put in a nice padded cell.

Therefore, select "A" Canadians. Stipulate if you will that they join up for service, anywhere, in the R.C.A.M.C. when needed. Preferably put them in uniform completely for 7 days a week, extending the present system, but without pay in the early stages. Let us have done with the aspersion that students are draft dodgers. It ought to be easy to determine which men have entered for medicine as their true vocation and which, if any, have hoped to find hide-outs. A young man is a fool who adopts Medicine as an escape when there are so many easy and "respectable" ways; some of them in army camps. Some of the boys, whom the ignorant deem slackers, look enviously to the camps where there is less labour, more leisure and more excitement and sports than they can find in their courses.

Recognize that we must have these men for the forces, the hospitals, and the country, even if we have to conscript them and train them at public expense. Remember that in the last war it was necessary to return medical students from France to complete their courses. We should see to it that we are not called upon to repair the effects of a similar mistaken enthusiasm in this war. It will be necessary if we permit certain self-appointed, hyper-zealous recruiters to exercise their sadistic instincts and drive these young men into other Services prematurely. Understand, as Principal James has pointed out, that the government considers that if these men are faithfully doing their work, they are taking their training and performing a high duty to their country.

Then cut down the purely military training to the absolute minimum in order that they may concentrate on the matter in hand. The medical course never did leave much time for additional activities. Have not more than one military period a week and put in the other required hours in extra camp training. Then a fourteen-day leave might be given before return to studies. Speed the courses as much as may be with the already over-worked staffs.

Certainly it takes more time to train a medical officer than a pilot officer; longer to build a battleship than a bomber, but they are still laying down battleships, and battleship squadrons are likely to become obsolete much sooner than Medical Services.

H. R. CLOUSTON.

Huntingdon, Que.,
November 8, 1942.

Special Correspondence

The London Letter

(From our own correspondent)

PLANNING FOR THE FUTURE

Annual B.M.A. Meeting.—The annual gathering, shorn of its social activities and its scientific meetings, devoted itself almost entirely to discussing the "plan" and listening to Sir Beckwith Whitehouse deliver the presidential address. This latter was a plea for the retention in "this uneasy world of change and planning" of "those traditional elements upon which the sound work of British medicine has evolved and been built". Sir Beckwith rightly says that the British public at heart dislikes the idea of communal methods of medical treatment (although it may not be true of *prevention*) but perhaps he was influenced by the B.M.A. representatives in their voting when he was almost as emphatic about the profession's dislike of working for a fixed salary.

With the president's remarks about the medical student in his difficult times today and his ideas of the future of medical education there will be much speculative agreement. Particularly interesting is the idea of a double test at the end of the medical curriculum, the first preceding and the second following a compulsory year's training devoted to some special aspect of medical work.

The annual representative meeting got down to a detailed discussion of the medical planning commission's interim report and demonstrated not for the first time one of the weaknesses of democracy—how to secure detailed views from a large body. For example by a very narrow majority (2 votes) the meeting agreed that provision (*i.e.*, of medical services) of whatever character should be made by the Government for the whole community and then later in the meeting decided by a majority of 157 *against* the establishment of a whole-time salaried Government service. So the commission, when it meets again to discuss its final report, has some headaches coming.

PÆDIATRIC PLANNING

Meanwhile the pædiatricians of this country, taking a great deal of their ammunition from the work of Professor Alan Brown and his col-

leagues in Toronto, have launched their planning schemes and driven a wedge well into public consciousness by an article in *The Times* and a new chair of Child Health at the University of Durham—established by the Nuffield Trust and filled by Dr. James C. Spence. In addition Professor L. G. Parsons has submitted a memorandum to the University of Birmingham about teaching pædiatrics in that city and it is hinted that plans are also being laid in London for the development of a pædiatric service.

Broadly, all these plans take the same line: a central hospital and research centre supplying consultive services for the health authorities in their school and child welfare medical work, with reciprocal opportunities for officers of these services to work in the hospitals. Thus prevention and treatment in diseases of children are to be integrated, and another important provision is contained in the plea for a closer association at the centre between the Ministry of Health and the consulting pædiatricians.

In the education of the medical student the main point made in the various schemes is that pædiatrics must be regarded as a major subject (again as in Canada) in the final examinations. At present, although theoretically attention must be paid to pædiatrics by the final examiners in medicine this is more honoured in the breach than in the observance, so that a large proportion of students take a chance and get through their qualifying tests without any knowledge of a subject which may form a third or more of their daily life in general practice. Pædiatricians are determined to end this shocking state of affairs and, in the words of *The Lancet*, "organized medicine is in danger of dropping behind public opinion in this matter".

NUTRITION

A Nutrition Council.—Not only has *The Times* opened its columns to pædiatric problems but it has recently discussed other matters of general biological interest including nutrition. After talking about food and food values *The Times* went on to propose the setting-up of a Nutrition Council, and for several weeks this has been discussed in various aspects by all shades of opinion from physicians to caterers. The trouble is that so many bodies are concerned: the Ministry of Food (described as "the most enlightened Government Department thrown up by the war"), the Ministry of Health, the Board of Education, the Medical Research Council, Agriculture, National Service, Man Power, Food Policy, Milk Board, and so on. One ex-president of the Royal College of Physicians thinks that for all the co-ordination necessary the Medical Research Council "is designed for just such a purpose", whereas another prominent physician thinks a new body must be found.

Finally, Sir John Orr brought the subject down to bedrock. In effect, he says, we know enough about food requirements for health, we know that about one-third of the population in this country (and a higher proportion elsewhere) do not get these requirements and therefore "the only nutrition council competent to deal with this vast question, which profoundly affects the whole social and economic structure is the Cabinet itself". With that Olympian pronouncement we must at present rest content.

ALAN MONCRIEFF

London, October, 1942.

Canadian Medical War Services

The Importance of Military Training

An article entitled "Doctor, and Soldier Too" by T. P. Buist, Lt.-Colonel, R.A.M.C., in the August 22, 1942, number of the *British Medical Journal* is worthy of perusal by all doctors who are either in the R.C.A.M.C., or are about to come in. In this article, Lt.-Colonel Buist discusses particularly the function of the army medical officer in the Royal Army Medical Corps. With reference to the Royal Canadian Army Medical Corps, many of the points raised by this R.A.M.C. officer are analogous to ours. He deals, for instance, with the case of an officer who has entered the R.A.M.C. as a specialist or graded specialist:

> "It is understandable that, knowing nothing of the Army, he may tend to assume that his work will be much the same as it was in civil life and that knowledge of such things as map-reading, medical boards, organization, military law, soldiers' affairs, and so on will not concern him. He may be sent to work in a C.C.S. or a military hospital and spend most of his time in his specialty. But it is unlikely that this will occupy him fully all day or every day, and in a military hospital there are many other duties in which he will be expected to bear his share when he is free. Not a few of them will require military as well as medical knowledge. He may, on the other hand, be sent to join a mobile surgical unit as its anæsthetist, perhaps to replace another who has become a casualty. He may find himself reporting for this duty somewhere in the desert, informed that his unit is at "Point X", 30 miles away, given a truck and a driver, and expected to carry on, perhaps in the dark. If he does not know how to find his way about he is likely to get lost; he may cause his driver and possibly others to lose their lives; and the mobile surgical unit may continue to be short an anæsthetist. Even the specialist must be a fitted piece in the military machine. If not, he may be a potential spanner in the works."

As regards the preliminary course of training for R.A.M.C. officers, Lt.-Colonel Buist says:

> "Doctors share with chaplains a privilege which is at the same time a disadvantage, in that they normally enter the Army as commissioned officers without any previous service or experience in the ranks. All other officers are now commissioned only after a period of service in the ranks followed by a training in an Officers' Training Centre. An untrained newly commissioned medical officer cannot avoid feeling a notable greenhorn in any congregation of officers. The additional training he receives should make him much more valuable to the Service, even in his own specialty.

"The preliminary course of instruction for R.A.M.C. officers is designed to reduce the acuteness of this disadvantage. It comprises five weeks' training in the Training Centre of the R.A.M.C., followed further by the training to be established at the Army School of Hygiene. During the course the metamorphosis is performed under expert and sympathetic guidance. The domestic change, shared with others at the same stage, becomes less drastic; the change of sphere, with new understanding, comes naturally; the change of horizon begins to develop. The officer emerges from the metamorphosis a fledgeling, perhaps, but not a self-conscious greenhorn, with a growing instinct of how to find his way about in his new work, with an increasing tactical sense, and feeling and looking fitter physically than he has done for years.

"It has been argued repeatedly that it is possible for a doctor to turn himself into a competent Army medical officer without attending a preliminary course of instruction; that, in fact, many have done so; and that such a course is a waste of valuable professional time. An analogous argument can be advanced that it is theoretically possible for a suitably gifted individual to become a competent doctor without attending a medical school. The medicine we practise today began with the work of such men. In both cases the process is hard on the aspirant and unfair to the patients. The path is long and rough and inevitably strewn with unnecessary casualties. That this is so in the case of the Army medical officer, those who have had to start work without a preliminary course are usually the most ready to admit.

"Finally, let it be said that the preliminary course is not a cramming course. Its aims are: to define the objects and principles of the medical care and management of soldiers; organization with close-ups of various aspects of a medical officer's life and work; to teach the new medical officer how to start to find the answer to 'What does A do now?' in various circumstances. It is in essence a reconnaissance; and to quote a well-known military axiom, 'time spent in reconnaissance is seldom wasted'."

Enlistment of Medical Students

In the last issue of the *Journal*, reference was made to the accelerated course in our nine medical schools. This was done following a meeting between the Deans of the Medical Faculties and the Adjutant-General, early in July, 1942. Canadian Army Routine Order 2391 explains as follows the regulations covering enlistment of medical students:

1. Students attending Canadian Medical Schools may be enlisted into the Canadian Army (Active) at any time during the last academic session or sessions at university prior to internship and during the period of internship whether graduate or undergraduate in character. The period of internship is not to exceed eight months and is to be included in the total period of enlistment which in any event is not to exceed twenty-four months. During this period students so enlisted will be granted leave, with pay and subsistence allowance, to enable them to complete their course, obtain a licence to practise and become eligible for appointment as medical officers in the armed forces of Canada.

2. The following regulations and instructions will govern the enlistment of the students attending medical schools at Canadian universities:—

(*a*) *Enlistment.*—(i) Provided students are physically fit (categories A, B or C) in accordance with the required medical standards and have been accepted by the District Medical Officer, they may be enlisted in the Canadian Army (Active) as privates at any time during the last academic session or sessions at university prior to internship, and during period of internship whether graduate or undergraduate in character.

(ii) As medical officers are required for the Navy, Army and Air Force the medical students, upon enlistment, will be afforded the opportunity to express their preference for the service to which they prefer to be appointed after obtaining a license to practise. No assurance can be given that appointment to the Service selected will be possible. The preference is to be expressed in the following pro forma which will be affixed to the M.F.M.2:—

"Providing a vacancy exists I prefer to be appointed to

(The Royal Canadian Navy
(The Canadian Army (Active)
(The Royal Canadian Air Force

upon becoming licentiate of Medical Council of Canada or receiving a license to practise the profession of medicine in one of the Provinces of Canada.

.....
Regtl. No. Name"

(iii) The D.M.O.'s should ascertain from Deans of Medicine the names of students volunteering for enlistment who are not considered likely to pass final examinations. Such students should not be enlisted.

(*b*) *Service.*—(i) Students in medicine will be enlisted into the R.C.A.M.C. or C.W.A.C. (as applicable) placed on strength of a District Depot or C.W.A.C. Coy., for all purposes, and granted leave of absence with pay and subsistence allowance, except as provided in sub-para. (*c*) (i) below.

(ii) The total period of enlistment during which leave of absence with pay and allowance will be granted is not to exceed 24 months.

(iii) It will be the responsibility of District Medical Officers to maintain close liaison with the Faculties of Medicine of universities within their respective Districts. They will familiarize themselves with the professional and scholastic qualifications and exercise general supervision in so far as Army matters are concerned, in regard to all students enlisted under these regulations.

(iv) D.M.O.'s will maintain a nominal roll of students enlisted and attending universities within their Districts and submit periodical confidential reports as directed by the D.G.M.S.

(v) During such time as the medical school is not in session students shall be liable to do duty with their unit, or be detailed for such military or professional duty as may be directed by the D.M.O.

(*c*) *Pay and allowances.*—(i) All students duly enlisted will receive pay of Private plus subsistence allowance at the authorized rate with the following exception: Medical students serving their internship in a hospital from which they receive free board and lodging will not receive subsistence allowance.

(ii) Dependents' allowance will not be paid to students enlisted under this scheme.

(*d*) *Dress.*—Students will wear uniform at all times except when in performance of duties connected with their studies, such as hospital intern duty, for which other dress is necessary, or as provided in dress regulations.

It will be seen by this Routine Order that students of the third, fourth and fifth sessions in the medical schools in Canada, where the internship is done in the final session, will now be eligible for enlistment in the Army if they pass the physical examination test and are acceptable by the Dean and the District Medical Officer concerned. This applies, likewise, to female medical students. In the medical schools where the internship session follows their graduation, then these students will be accepted for their two final sessions, plus their eight months' internship session. This internship session is not to exceed eight months, and

is to be included in the total period of enlistment which, in any event, is not to exceed twenty-four months.

The Army's Needs

The R.C.A.M.C. needs doctors, needs them immediately. There is a definite emergency, and this can best be filled by the enlistment of keen, young physicians who have completed their internship and who are anxious to take their place in the Medical Service at once. Fifteen per cent of the total number of physicians in Canada at the present time can be spared for military service, and still leave 65% of the total number of physicians registered in Canada to carry on civilian medical practices.

A sincere effort is being made by the R.C.A.M.C. to place men in the same type of work for which they received special training in their civilian medical practice. The papers of every medical officer appointed are carefully examined by the Directorate of Personnel, N.D.H.Q., Ottawa. Those individuals who have had training in any special field of medicine can best serve their country doing their own line of work. It is intended to put the round pegs into round holes; the R.C.A.M.C. does not wish to have general surgeons doing radiology, nor trained internists carrying on indefinitely as unit medical officers. Therefore, if you are a qualified specialist, you can be assured that every effort will be made to continue you in an assignment in keeping with your qualifications and experience. This will keep the level of military medicine on a high plane, and at the same time further the education of the individual concerned and increase the standards of medical care for the soldiers in the front lines.

It is proposed to see that young graduates in medicine are not allowed to go to seed. They are to receive refresher courses, and after a proper term of service in units, to be posted to hospitals where they can participate in direct clinical work under the supervision of well-trained internists, surgeons, radiologists and pathologists.

But we must have young men now! They are needed for overseas service, and with this call from the nation for action we feel that the young doctors in Canada will gladly respond to the call and enlist immediately. Our Army is a young Army; it needs young doctors; doctors of troop age, forty-five years or younger; men who can work in the field hospitals, mobile hospitals, ambulances, medical units and other medical installations. Older doctors can fill the establishments of our home war establishments, while still older doctors with the assistance of men whose medical category makes them fit for practice, but unfit for medical service, will carry on the civilian work and see that civilian institutions and practices are maintained to function efficiently.

Young doctors will never regret their service in the Army. In this age they need the Army to round out their experience; while, on the other hand, the Army badly needs them.

Brigadier Meakins Addresses the Annual Meeting of the Royal College of Physicians and Surgeons of Canada

Brigadier Jonathan C. Meakins, D.D.G.M.S. (P) addressed the annual meeting of the Royal College of Physicians and Surgeons of Canada, at the National Research Council on Saturday, October 24th.

Brigadier Meakins spoke on the present concepts of the "Etiology, physiological disturbances and treatment of shock". He pointed out that "Shock" was a clinical syndrome common to the terminal stages of many diseased conditions. The earliest signs were elusive and hard to define. It was only when well established that it was acknowledged and then reversal of the reaction was difficult, although much could be done under certain circumstances to help. There was no specific cure or prevention but each case or similar group of cases had to be handled separately, and according to their needs and chiefly by early substitution therapy. Many etiological theories had been advanced which were often antagonistic to each other. Results were often put forward as causes, still further leading to confusion.

Brigadier Meakins was the 1942 lecturer of the Royal College of Physicians and Surgeons of Canada, and was their first President. He has recently resigned his position as Dean of Medicine in McGill University, and Professor of Medicine and Chief of the Medical Staff of the Royal Victoria Hospital, Montreal, in order to take over charge of professional activities in the Royal Canadian Army Medical Corps.

Royal Canadian Air Force

Since the R.C.A.F. Medical Branch was established in September, 1940, there have been seventeen sessions of the School of Aviation Medicine.

In spite of the original shortage of medical officers, practically every entrant has been through the course. This was made possible only by the co-operation of station medical officers, who worked over time, and often without time off. This situation has now changed for the better, and all incoming medical officers go to the School before posting to units.

Women doctors were taken into the R.C.A.F. in August, 1941, owing to the organization of the Women's Division. Their establishment has justified itself, and has proved a great step forward. They go through the School of Aviation Medicine like their confrères. They are commissioned in the Medical Branch, and not

in the Women's Division. Thus, their status is exactly the same as that of the male medical officers, as regards terms of service, pay, promotion and pensionable rights.

With the infiltration of Canadian personnel into all theatres of war, medical officers are seeing service far afield, and this has necessitated a widening of the syllabus of the School. Tropical medicine has become an important study, and all steps are taken to familiarize medical officers with the conditions existing in the tropics.

Not only is protection needed against the parasites encountered, but clothing of flying personnel has become a special study, since conditions of warfare have changed, and, with them, the type of clothing hitherto found satisfactory in previous wars.

Selection of airmen has its problems, requiring as it does probing of motivation, aptitude and determination; maintenance of airmen, prevention of wastage and salvaging are the responsibilities of the medical officer. The anticipation of fatigue, effects of glare, and potential anxiety states, all come within his scope. The duties of the medical officer, therefore, cover a wide field, and it is only by the "following-up" of airmen who have been selected for flying duties, and the collection of data that certain standards can be justified.

The interest of medical officers in their professional duties is not forgotten. A routine is effective whereby officers are attached to the larger hospitals for a period of post-graduate work, and there is no doubt that, as the war progresses, this routine will be put into general effect, even when serving abroad.

R. W. RYAN, *Air Commodore,*
Director Medical Services (Air).

Nurses in the R.C.A.M.C.

We learn from Matron-in-Chief Elizabeth Smellie that, as at September 30, 1942, there were 1,236 nurses on the strength of the Royal Canadian Army Medical Corps in Canada and overseas, including 68 dietitians, physiotherapy aides and Home Sisters. This does not include the 300 who volunteered for service in South Africa and are now on duty with the South African Nursing Service.

There is we understand no lack of applicants for enlistment, but caution has to be exercised in accepting applications because of the needs of civilian institutions and of the general public.

Miscellany

The Profession in England

"You know what he is doing?" said my colleague in the tone of one describing a nameless enormity, "he is advising half-a-dozen commercial firms, and I have heard he even takes a hand in the advertising of one of them!" "Why shouldn't he?" I asked. "Good heavens, man, he is a professor in a medical school and a qualified doctor. A fellow in that position should have no truck with anything commercial." I did not see this, and said so, with the result that the discussion tended towards the acrimonious. (After all, we know each other intimately.) I did agree that this kind of thing might occasionally lead to abuse, but that seemed no reason to condemn the practice any more than the existence of a few dishonest doctors can be taken as proof that all the profession is corrupt—even though some novelists may do so with impunity. I argued that if a commercial firm is engaged in any activity impinging on the field of health clearly they must have skilled advice, and many employ completely reputable doctors on a full-time basis. There are many occasions, however, when either some special problem arises or a full-time appointment is uneconomic. It is in the interest not only of the firm but of the public also that the advice they seek should be of the best quality. It is only fair that such advice should be remunerated. Q.E.D.

My colleague was unappeased, and while he was gathering breath for a counter-attack I swept on. This *noli-tangere* view adopted by our universities and research institutions to commercial contacts and problems has, I urged, done the country a lot of harm. In German universities they adopt the reverse attitude. For example, I met a professor of international repute working in one of the research laboratories of the I.G. Company. I was a little surprised to see him, and really surprised when I learnt he was on the pay roll for a more substantial sum than the university paid him for his chair. He spent something like three long afternoons a week in his department and the remainder of the time in the commercial laboratory. The arrangement suited both sides—the university obtained the services of a first-class man for a much smaller salary than they would otherwise have had to pay, and the company had the kudos of a professor of high standing on their staff. This case was only one of many, and I think the system was one of the chief reasons for the advanced position which German industry held in so many fields before the war. It was also the reason why they could provide so many ersatz substances to replace materials obtainable only from abroad.

I should like to see our universities setting up departments of industrial co-operation, each ac-

cording to its special facilities. These departments would be available in an advisory capacity to commercial firms or trade associations. Research on specific problems or the general basic problems of the industry could be carried out. Fees could be charged for advice which would be split appropriately between the university and the department staff. But, perhaps most important, students both undergraduate and postgraduate would be trained in the actual problems of an industry which they would later enter. Some industries have already set up machinery which approximates to the idea in some directions at least—for example, in wool research and rubber research—but the idea is capable of much wider application. Bristol could specialize in physical problems, Manchester in chemistry; Leeds could have a department of wool technology and dyeing; Sheffield could extend its metallurgical work still further, and London would be a centre for economic consultation. Edinburgh ought to be a special centre for pharmacological investigation and Aberdeen might take on the food industry. The educational pundits will raise their hands in horror at such a plan, and maintain that the sciences must stick to fundamentals and eschew practical applications. The best answer to them is Aberdeen's motto "They say, what say they, let them say." The universities can no longer dream quietly; they must adjust themselves to the impact of events. We do not need to become soulless pragmatists, but we must be practical.

From "In England Now", *The Lancet.*

Abstracts from Current Literature

Medicine

The Sensitivity to Hypertension, Adrenalin, and Renin of Unanæsthetized, Normal, Adrenalectomized, Hypophysectomized and Nephrectomized Dogs. Houssay, B. A. and Dexter, L.: *Ann. Int. Med.*, 1942, **17**: 451.

The authors determined the sensitivity of unanæsthetized normal, adrenalectomized, and nephrectomized (uræmic) dogs to two units of hypertensin, 10 gamma of adrenalin, and 2 c.c. of a solution of hog renin.

Forty-eight hours after bilateral adrenalectomy, the sensitivity to hypertensin and adrenalin was usually normal unless terminal shock appeared. The sensitivity to renin was sometimes normal and sometimes reduced. The decrease in the sensitivity to renin at a time when the vessels were reacting normally to hypertensin was associated in four instances with a fall in the concentration of hypertensin precursor (hypertensinogen) in the plasma.

Dogs hypophysectomized one month to three years previously reacted normally to the injection of hypertensin, adrenalin and renin.

Chloralosed dogs recently nephrectomized reacted normally to hypertensin and adrenalin, and usually to renin. In three of nine dogs the pressor effect of renin was greater, and in two of nine it lasted distinctly longer than in the normal controls.

Unanæsthetized dogs nephrectomized 48 hours previously frequently were hypersensitive to hypertensin, adrenalin, and renin. The duration of action of renin was usually markedly prolonged. The causes of the hypersensitivity to renin in these dogs are discussed.

S. R. TOWNSEND

Acute Coronary Thrombosis in Industry. I Direct Non-penetrating Injuries with Report of Cases. Leinoff, H. D.: *Arch. Int. Med.*, 1942, **70**: 33.

Compensation law allows benefits for a disease caused, aggravated or precipitated by an incident arising out of and during the course of employment. Coronary disease produces some of the most difficult problems in this connection, and the author presents this clinical study in order to clarify the situation. Seventeen cases are presented, the usual diagnosis being acute coronary thrombosis and myocardial infarction. Two groups of the injuries are made, direct and indirect violence.

There is great difference of opinion as to whether trauma to the outside of the chest can cause cardiac disease. The author emphasizes that an exact history taken at the time of the accident is the most important measure as far as compensation is concerned.

The injuries include being struck by a heavy object, falling against a hard surface, such as being thrown against the wheel of a car in an auto accident. Frequently the patient developed severe cardiac pains soon after the trauma which might become more intense a few hours later along with serious collapse of circulation. Most of the cases were left with a definitely damaged heart. Electrocardiographic tracings always established the presence of thrombosis, when taken in series. On some cases pre-existing heart disease complicated the situation and made the assessment of benefit most difficult, and in others an effort was made to make an industrial accident the cause of a condition, when the condition had no relation to the injury. On the other hand workmen often continued working until forced to give up by cardiac symptoms, and it was discovered that they were permanently incapacitated.

Almost all the patients were people in their forties or fifties. There is of course great variation in the actual mechanism of heart injury—whether the heart suffers from being thrown against a bony wall, whether it is compressed, torn from its attachments, jarred seriously, or bruised by broken bony edges.

The picture presented includes pain, dyspnœa, rapid heart, dizziness, unconsciousness, weakness, distant heart sounds, disturbed rate and rhythm, systolic murmur, due to a mild dilatation of the left ventricle, and electrocardiographic changes. Examination at the acute stage, *i.e.*, right after the accident, is very important and should be given first place in a court hearing of a claim as there is no thought of anything but relief from symptoms.

The author makes a very good case for the occurrence of coronary thrombosis as a result of non-penetrating injuries to the chest.

P. M. MACDONNELL

Some Epidemiological Features of Poliomyelitis and Encephalitis, Manitoba, 1941. Donovan, C. R. and Bowman, M.: *Can. Pub. Health Jour.*, 1942, **33**: 246.

The combined epidemics of poliomyelitis and encephalitis which occurred in Manitoba and neighbouring Provinces and States in 1941 are discussed from the standpoint of epidemiology. The following are some of the epidemiological facts:

Geographical distribution.

	Poliomyelitis per 100,000	*Encephalitis* per 100,000
Winnipeg	125 cases	49 cases
Suburbs of Winnipeg	253 "	79 "
Remainder of Province ..	117 "	79 "

Seasonal occurrence.—The poliomyelitis epidemic lasted from early June until early September and reached its peak the week of August 12th.

The encephalitis epidemic lasted from the end of June until late September and reached its peak the week of August 19th.

Age and sex distribution.

	Poliomyelitis		*Encephalitis*	
	Males cases	*Females* cases	*Males* cases	*Females* cases
Under 15 years	396	273	44	28
Over 15 years	176	121	307	130

Case fatality.—Poliomyelitis 1.8%; encephalitis 15.3%.

So far as poliomyelitis is concerned the epidemic sheds no further light on the method by which the disease is spread. In regard to encephalitis the study seemed to indicate that contact between sick and well human beings and sick horses and humans was not a factor in the spread. Suspicion is directed towards some vector, possibly a mosquito. Temperature and rainfall seemed to have no causal relationship to the epidemic. FRANK G. PEDLEY

Familial Mental Deficiency Akin to Amaurotic Kidney and Gargoylism. Jarvis, G. A.: *Arch. Neurol. & Psychiat.*, 1942, **47**: 943.

These six affected children were the offspring of first cousins, the parents being the offspring of two brothers. Three boys and three girls were affected, being the third, fourth, fifth, sixth, eighth and ninth children of a family of nine. One boy and two girls were normal. The affected members showed severe idiocy, stunted growth, the facies characteristic of gargoylism, also the bony changes in the skull found in that disease. In addition, the nerve cells were swollen, and infiltrated with lipoid granules as is found in amaurotic idiocy. Inasmuch as these six defectives were the offspring of first cousins, and there was no history of any similar defect in the seven sibs of the father or of the three sibs of the mother, the defect is probably inherited as a recessive. MADGE THURLOW MACKLIN

Surgery

Prothrombin Test as a Diagnostic and Prognostic Aid. Abbott, W. E. and Holden, W. D.: *Arch. Surg.*, 1942, **45**: 261.

The authors present additional evidence to support the belief that the results of the prothrombin test are helpful in making an accurate diagnosis in the jaundiced patient. In many instances a rough estimation of the extent of liver dysfunction can be determined. The prothrombin test was carried out on 120 patients, most of whom had hypoprothrombinæmia. The results of the test in 36 patients with intestinal dysfunction are presented to give further support to previous conclusions, that hypoprothrombinæmia develops owing to lack of adequate food, loss of bile from the intestinal tract or a combination of the two. The method employed was the test described by Quick.

The following groups were studied: leukæmia, Laennec's cirrhosis, tumour obstructing the bile ducts, common-duct obstruction due to calculus, stricture of the common duct, biliary fistula, burns, intestinal dysfunction and miscellaneous cases, including heart disease with decompensation, hepatitis, catarrhal jaundice and Weil's disease. The authors conclude that the prothrombin test which can be simply done and is inexpensive, is an aid in determining the type of jaundice. In the series presented it has been shown that patients with relatively severe liver damage do not respond to vitamin K therapy and that patients with common duct obstruction practically always respond to adequate therapy. The severity of liver damage in burns can be determined by this test and it is thought that by serial examinations an early and accurate prognosis can be formulated. G. E. LEARMONTH

Association of Pernicious Anæmia and Carcinoma of the Stomach. Doehring, P. C. and Ensterman, R. B.: *Arch. Surg.*, 1942, **45**: 554.

Apparently the incidence of carcinoma of the stomach among persons afflicted with pernicious anæmia is increasing, but whether the increase has any relation to the pathological processes concerned in pernicious anæmia or is due merely

to the fact that today more patients with pernicious anæmia are living longer into the cancer age as the result of liver therapy than patients of this type did formerly, is impossible to say at present.

The authors refer to 15 patients with associated pernicious anæmia and carcinoma of the stomach in addition to 25 similar cases previously reported from the Mayo Clinic. Between 1935 and 1939 inclusive approximately 1,014 patients with pernicious anæmia were seen at this clinic. Seventeen had carcinoma of the stomach also, a slightly higher incidence than the calculated incidence of gastric carcinoma among the adult general population. Carcinoma in these cases was similar in situation and grade of malignancy to carcinoma of the stomach in cases in which it is not complicated by pernicious anæmia. The average age at which the onset of symptoms referable to pernicious anæmia occurred was 54.5 years while that at which the symptoms of carcinoma of the stomach appeared was 63.2 years. Present evidence is insufficient to prove a direct relation between the two diseases. There are grounds for suspecting that persons with pernicious anæmia are slightly more likely than normal persons to have gastric carcinoma. G. E. LEARMONTH

Sarcoma of the Small Intestine. "Sarcôme de l'Intestine Grêle". Wallace, F. L., Miller, A. J. and Bell, J. C.: *Ann. Surg.*, 1942, **115**: 544.

Le sarcôme de l'intestin grêle est rare, plus fréquent chez les hommes et chez les personnes d'âge mûr. Son origine est le plus souvent traumatique. Les symptômes en sont généralement insidieux et varient selon l'endroit où est située la lésion; les cas de perforation sont rares de même que les hémorragies massives. Le diagnostic sera basé sur les éléments suivants: douleur abdominale, sang dans les selles, perte de poids et présence d'une tumeur abdominale dont la localisation au toucher est souvent intermittente. Le plus souvent le diagnostic du sarcôme de l'intestin grêle est post-opératoire.

Les lésions répondent aux types pathologiques suivants: lymphosarcôme, myosarcôme, léiomyosarcôme, fibrosarcôme, neurofibrosarcôme. L'auteur les passe en revue à l'aide de tableaux divers. Au pointe de vue localisation, les lésions peuvent affecter le duodénum, le jéjunum, l'iléon, le diverticule de Meckel ou coexister en maints endroits sur le grêle.

Le seul traitement qui s'impose est l'extirpation radicale du sarcôme. Sauf dans les cas de lymphosarcôme, le traitement chirurgical s'avère curatif s'il est pratiqué de bonne heure, parce qu'il n'y a pas de métastase rapide.

En ce qui concerne les méthodes radiologiques l'auteur conseille de bien considérer la nature histologique, la pathologie et la localisation des lésions avant de les appliquer. PIERRE SMITH

Factors Influencing the Incidence of Postoperative Thrombophlebitis in Gynæcologic Surgery. "Facteurs Favorisant l'Apparition des Thombophlébites Post-opératoires en Chirurgie Gynécologique." Counseller, V. S. and McKinnon, D. A.: *Surg., Gyn. & Obst.*, 1942, **75**: 114.

Les auteurs constatent que l'apparition des thrombophlébites post-opératoires est plus fréquent après une hystérectomie sub-totale qu'après une hystérectomie totale. L'explication de cette différence réside probablement dans la relation entre l'opération et les ligaments larges. Dans la sub-totale, les veines et les ligaments larges subissent un traumatisme mais restent en place, alors que dans la totale la plupart des veines sont excisées ou raccourcies, laissant ainsi une surface moins étendue de tissu endothélial pour le développement des thromboses.

La présence de veines variqueuses est le facteur prédominant qui prédispose aux thrombophlébites post-opératoires. Mentionnons aussi l'anémie grave, l'obésité, l'infection et l'endométrite.

Dans 75% des cas, les thrombophlébites surviennent aux extrémités inférieures. Elles se produisent habituellement dans la saphène interne ou la veine fémorale.

On note rarement l'apparition de thrombophlébites avant le 8ème jour post-opératoire, tout au moins dans ses manifestations cliniques permettant un diagnostic précis. Mais la réaction musculaire et l'obstruction veineuse que l'on décèle alors ont débuté, en réalité, aux environs du 3ème jour.

Les transfusions pré- et post-opératoires ne semblent pas avoir une influence déterminante sur l'apparition des thrombophlébites.

Les auteurs recommandent les thérapeutiques habituelles et l'usage préventif de la chaleur sèche afin de diminuer les chances de complications aux extrémités inférieures ou de hâter la guérison des phlébites. PIERRE SMITH

Obstetrics and Gynæcology

A Case of Intra-uterine Infection of the Fetus by Gas-gangrene Organisms. Kemp, F. H. and Stallworthy, J. A.: *Brit. M. J.*, 1942, **2**: 94.

This is a case of intra-uterine infection of the fetus with gas-forming organisms occurring in a woman suffering from diabetes mellitus. Hydramnios and increasing œdema of the lower extremities developed at the thirty-second week of gestation, and at this time there was considerable difficulty in controlling the diabetes. A fortnight later there were signs of fetal death, and radiographic examination revealed bubbles of gas within the fetal skull. Seventeen days after this a macerated fetus was delivered and a pure culture of *Cl. Welchii* was obtained from its intracranial contents. There was no evidence

of maternal toxæmia due to gas-forming organisms either before or after delivery. It is difficult to explain the path of infection; there had been at this time no interference, and no vaginal examination had been made. There was no evidence of a low-lying placenta, and no apparent focus of infection in either the mother or the infant. It would seem that the infection was blood-borne and transmitted through the placenta. Unfortunately, the placenta was not examined bacteriologically. ROSS MITCHELL

The Problem of Unsuspected Tuberculosis in Pregnancy. Eisele, C. W., Tucker, W. B., Vines, R. W. and Batty, J. L.: *Am. J. Obst. & Gyn.*, 1942, **44**: 183.

The inadequacy of symptoms and physical examinations as means of discovering pulmonary tuberculosis is discussed. An error of 90% may be expected when these methods alone are used. Routine chest fluoroscopy followed by roentgenograms in all cases with definite or suspected pulmonary lesions is a satisfactory method of finding tuberculosis when carried out by an experienced examiner trained in fluoroscopic technique and lung diseases.

Application of this method to 10,968 pregnant women, unselected except for the exclusion of known tuberculosis, disclosed 110 cases of unsuspected clinically important tuberculosis, or an incidence of 1%. Seventy-four cases, or 0.7%, were shown to be active during the pregnancy. The incidence of unsuspected tuberculosis has remained nearly the same for the two periods of this investigation, namely, 1.06% from 1934 to 1937, and 0.96% during 1937 to 1941. In contrast to this, the incidence of unsuspected syphilis declined markedly, from 0.87% during 1934 to 1937 to 0.30% during 1937 to 1941. This decline may be attributed to the passage of the Illinois hygienic marriage law in 1937.

Routine chest roentgenological examination should rank with routine Wassermann tests as a medical necessity in pregnant women. The desirability of premarital laws relating to tuberculosis similar to those relating to syphilis is discussed.

Tuberculosis in pregnant women is still an important problem, for, although it has declined from first to seventh place as a cause of death in the general population, it still remains the leading cause of death for women of the childbearing age. The tuberculosis toll in this age-sex group accounts for 20% of all deaths, twice as high a mortality as from all puerperal causes. ROSS MITCHELL

The Treatment of Functional Uterine Hæmorrhage with the Anti-menorrhagic Factor. Sutherland, A. M.: *J. Obst. & Gyn. of the Brit. Emp.*, 1942, **49**: 156.

Many patients suffer from uterine hæmorrhage in the absence of any recognizable pathological lesion of the reproductive organs to explain it. Bleeding of this type is usually referred to as "functional", and there is a tendency to attribute it, without any real evidence, to endocrine disorder.

The present series of 50 cases of patients suffering from functional uterine hæmorrhage were treated at the out-patient department of Dr. Hewitt's unit at the Royal Samaritan Hospital for Women. In every case the patient's primary complaint was one of definitely abnormal uterine bleeding. With four exceptions, all patients aged 40 or over were excluded, since it was considered advisable to admit such patients for early diagnostic curettage. The four patients in this series aged 40 had already had this operation performed with negative result. All patients with any obvious pelvic lesion which might account for the bleeding were also excluded. In three of the patients a single, small, subserous or intramural fibroid was present. The largest fibroid was about the size of a marble, and it was not thought from the size and situation of the fibroids that they were responsible for the excessive bleeding. Various forms of treatment had previously been carried out without success in a number of the cases in the Samaritan Hospital or elsewhere. In 7 patients dilatation and curettage had been performed. The object of the present communication is to state the results obtained in these cases by the administration of a recently introduced liver factor. When a patient was first seen during a period of bleeding, 2 granules were given 3 times daily until the bleeding ceased. If the menstrual cycle was regular treatment was then discontinued until a week before the expected onset of the next menstrual period. The subsequent dosage depended on the response to treatment, but was usually 1 granule thrice daily until the end of the period, the course being repeated as required. P. J. KEARNS

Placenta Accreta; with a Report of Two Cases. Cunningham, J. F.: *J. Obst. & Gyn. of the Brit. Emp.*, 1942, **49**: 149.

In the two cases there were two other signs worth noting. Firstly, the local tenderness in the uterine wall, and, secondly, the inertia of the uterus during labour. The deep penetration of the placenta into the uterine muscle which was present in each of these cases will explain both these findings. The total mortality rate in placenta accreta is about 38%, and is dependent very largely on the method of treatment employed. In patients treated by manual removal, with or without tamponade of the uterus it is about 70%. Vaginal hysterectomy gives a rate of 36%, and abdominal hysterectomy, a rate of less than 6%. The treatment, therefore, is obvious. If the placenta is completely adherent and resists the usual attempt at manual removal, abdominal hysterectomy should be performed without delay. If the ad-

hesion of the placenta is only partial, but if a considerable portion of its surface is involved, hysterectomy is still indicated. If the adherent portion is small the operator may decide on conservative treatment; but he must be prepared to deal with secondary post-partum hæmorrhage and sepsis, as perhaps the least of the complications likely to ensue. If post-partum hæmorrhage occurs, either following an attempted manual removal or in a case of partial placenta accreta, the uterus should be packed until preparations have been made for a laparotomy. Morphia, salines and blood-transfusion are invaluable to combat shock and blood-loss.

P. J. KEARNS

Oto-Rhino-Laryngology

The Rôle of the Epiglottis in Anæsthetic Deaths. Caiger, G. H.: *J. Laryn. & Otol.*, 1942, **57**: 250.

The author believes that the non-recognition of epiglottic impaction during anæsthesia is an occasional cause of death. He quotes his experience with some half-dozen cases in which the impaction was relieved by digital means. This condition is seen in ether anæsthesia. The author believes that during the relaxation produced by the anæsthetic the epiglottis is carried by the rush of inspired air part way through the glottis where it becomes impacted. He suggests that in all cases in which cessation of respiration occurs during an anæsthetic careful examination be made to make sure that the cause is not an impacted epiglottis. G. FISK

Radiology and Physiotherapy

A Survey of Hodgkin's Disease and Lymphosarcoma in Bone. Vieta, J. O., Friedell, H. L. and Craver, L. F.: *Radiology*, 1942, **39**: 1.

Bone involvement by Hodgkin's disease and lymphosarcoma is not uncommon and represents an important complication of these two diseases. The lesions are most frequently found in the pelvis, vertebræ, ribs, and femora, and in most cases involve more than one bone. Localized pain and tenderness were the most frequent clinical indications of bone lesions, but tumours about the bone margins, and neurological changes due to extension into the spinal canal from vertebral lesions were also observed.

On roentgenographic study, lesions were demonstrated in 14.8% of 257 patients with Hodgkin's disease and 7% of 213 cases of lymphosarcoma.

Bone lesions in Hodgkin's disease and lymphosarcoma occurred at any point during the course of the disease. In lymphosarcoma bone lesions were found to develop in 63% of the patients in the final one-third of the disease span. In contradistinction to this, in only 31% of the patients with Hodgkin's disease did bone lesions appear during this portion of the course. This is of prognostic significance and would indicate that development of bone lesions in lymphosarcoma is often a terminal event.

Radiation therapy offers definite amelioration of symptoms in the osseous lesions of Hodgkin's disease and, in some cases, completely restores the invaded bone to its normal structure.

Radiation therapy offers definite amelioration of symptoms in the osseous lesions of Hodgkin's disease and, in some cases, completely restores the invaded bone to its normal structure.

Similar clinical improvement occurred in lymphosarcoma after radiation therapy, but no opportunity to follow the bone changes was available because of the short average survival after skeletal invasion. R. C. BURR

Tumours of the Urinary Bladder. Hiemstra, W. and Creevy, C. D.: *Radiology*, 1942, **39**: 11.

Various data relative to tumour of the bladder are presented.

The delay of treatment for carcinoma (2.3 years) could be materially reduced by increased co-operation of the physicians and education of the public. The toll of carcinoma of the bladder may thus be considerably reduced.

Hæmaturia, which is the commonest first symptom, demands serious consideration in every instance in which it occurs.

The results of the treatment of carcinoma of the bladder are not good. With careful attention to detail, these may be improved with radon and radium therapy in suitable cases. Contact and, possibly, supervoltage x-ray therapy may prove of value. External irradiation has not been as effective as was previously thought, especially in doses of less than 3,000 tissue r to the tumour.

Metastases appear more frequently than is generally believed, and should be diligently sought if a radical surgical procedure is contemplated. R. C. BURR

Anæsthesia

The Use of Curare in General Anæsthesia. Griffith, H. R. and Johnson, G. E.: *Anæsthesiology*, 1942, **3**: 418.

This is a preliminary report on the use of a drug to provide rapid and complete muscular relaxation in resistant patients under general anæsthesia. The relaxation is provided temporarily and apparently harmlessly. Curare, the drug employed, has long been recognized as an interrupter of the neuro-muscular mechanism. A purified form, intocostrin (extract of unauthenticated curare, Squibb) has been employed by the authors in order to increase skeletal muscular relaxation in patients under general anæsthesia. It has been given to 25 patients and in each case there was rapid and complete relaxation which developed within one minute after intravenous injection of the drug and gradually disappeared after ten to fifteen minutes. There have been no undesirable re-

actions observed and no demonstrable postoperative effect. The drug, intocostrin, is administered intravenously with a dosage of 10 to 20 mgm. of the active curare per 20 lb. of body weight. Since intocostrin is prepared in solution containing 20 mgm. of the active curare substance per cubic centimeter, an average adult dose is 4 to 5 c.c. The authors have not given more than 5 c.c. to any one patient. The injection is made rather rapidly, in less than a minute. Resuscitation has never been necessary but an antidote for curare is *prostigmine,* an ampoule of which should always be available.

All patients were under cyclopropane anæsthesia and ranged in age from 18 to 70 years. In all cases relaxation was readily afforded. Its scope of usefulness is limited because of its somewhat fleeting action and because it is in no sense an anæsthetic agent.

F. ARTHUR H. WILKINSON

Therapeutics

Simultaneous Administration of Diphtheria Toxoid and Pertussis Vaccine in Young Children. Sauer, L. W. and Tucker, W. H.: *Am. J. Pub. Health.,* 1942, **32**: 385.

Sauer and Tucker have experimented with the simultaneous inoculation of young children with diphtheria toxoid and pertussis vaccine. They report the inoculation of 464 infants. Two hundred and eight were given the substances separately, but at the same time 256 were given a mixed antigen of the same strength. Three doses at three weeks' interval were given as follows: 1st dose 1 c.c. toxoid, 30,000 million pertussis organisms; 2nd dose 1 c.c. toxoid, 30,000 million pertussis organisms; 3rd dose 1 c.c. toxoid, 45,000 million pertussis organisms.

Regardless of the method of administration (whether separate or mixed) over 90% of infants gave a negative Schick test 6 weeks after inoculation. Using the complement fixation test as an index of response to pertussis vaccine 91% of the children who received the antigen separately reacted positively and 73% of those who had received the mixed antigen. All the negative reactors subsequently became positive after a further "stimulating" dose. FRANK G. PEDLEY

Sulfaguanidine Non-effective in the Treatment of Typhoid Fever and Typhoid Carriers. Watt, J. and Peterson, J. S.: *U.S. Pub. Health Rep.,* 1942, **57**: 872.

Six hospitalized, moderately ill patients with proved typhoid fever were given five-gram doses of sulfaguanidine four times a day for periods of 8 to 10 days. In all cases there was no unusual clinical improvement. All recovered, but there was no indication that the drug affected in any way the fever or other clinical signs and symptoms. Stool cultures were obtained daily. All became negative at about the usual time for the uncomplicated case of this disease, namely, about the time the temperature became normal.

Cultures were made from three known chronic carriers of typhoid bacilli for six days. They were then given 15 grams of sulfaguanidine daily for 14 days. Stool specimens continued to be positive and there was no diminution in the number of colonies found per plate of Wilson-Blair medium. FRANK G. PEDLEY

Pathology and Experimental Medicine

A Study of a Cystinuric Family. Andrews, J. C. and Brooks, R. E.: *J. Urology,* 1942, **47**: 171.

This relatively rare anomaly of metabolism is inherited, and, from the family here reported, appears to behave as a dominant character, passing from affected parent to some of the children, while leaving others free. There were seven cases in three generations, an affected grandfather, three of his five daughters, and three grandchildren. One of these was a daughter of an affected mother, but the other two were children of one of the unaffected females in the second generation. The disease is often characterized by the formation of renal calculi of pure cysteine, which may require operative removal. MADGE THURLOW MACKLIN

Laurence-Moon-Biedl Syndrome: Report of a Case in a Negro Family. Snell, A. C.: *Arch. Ophth.,* 1942, **28**: 12.

Up to 1939 there had been 150 cases of this disease collected and reported in the literature. With the exception of two cases in Japanese, and one in an Egyptian, all were in those of the Caucasian race. This is the first case reported in the Negro race. The parents were not related so far as known. They had eight children; the first, second, fourth, fifth and eighth being normal. The third, a girl, had bilateral macular degeneration and some skeletal deformities. The sixth, a girl, was very obese and had an extra digit on each extremity. The seventh had four of the five cardinal symptoms of this syndrome, showing polydactyly, obesity, mental retardation, retinitis pigmentosum, but had normal genital development. MADGE THURLOW MACKLIN

Amaurotic Idiocy in Identical Twins. Klinger, L. H. and Blauner, S. A.: *Am. J. Dis. Children,* 1942, **64**: 492.

These identical twin sisters, offspring of two Russian Jews, unrelated as far as known, showed all the typical symptoms of amaurotic idiocy. The author states that, so far as he knows, this is the first published instance of this disease in both members of an identical twin pair.

NOTE: I have encountered five instances of twins (type not stated) in the literature, with but one affected, and one instance by Nettleship of twin girls with both affected. He did not say

whether they were identical twins or not, but being the same sex, they may have been.

MADGE THURLOW MACKLIN

Hygiene and Public Health

Indiscriminate Administration of Vitamins to Workers in Industry. Council on Foods and Nutrition and the Council on Industrial Health, American Medical Association, *J. Am. M. Ass.*, 1942, **118**: 618.

The Council on Foods and Nutrition and the Council on Industrial Health of the American Medical Association disapprove of the mass administration of vitamins to industrial workers for the following reasons: (1) it is irrational from a therapeutic point of view; (2) it is unwise, nutritionally, because special vitamin preparations cannot take the place of valuable natural foods; (3) a good diet can provide all that vitamin preparations have to offer; (4) it is expensive.

The National Nutrition Conference for Defense held in 1941 recognized that so little is known of workers' diets that rigidly controlled studies were indicated. Following such studies, if deficiencies were noted, they should be made up by correction of diets. No suggestion was made that such deficiencies should be made up by the administration of vitamin concentrates.

The Committee on Nutrition in Industry of the National Research Council did make a survey during the three summer months of 1941. This survey revealed that there was much room for improvement in plant cafeterias. It was found that little attention was paid to the kinds of foods served in these cafeterias from the point of view of modern nutrition. Actually some of the plants with cafeterias had under consideration the administration of vitamins to their employees.

There is, of course, a tendency on the part of commercial concerns to exploit the public interest in vitamins and several companies have been formed for the express purpose of promoting the sale of vitamins in industry. The claims made by these promotion schemes have no solid scientific foundation.

In the case of industries where specific hazards exist, such as metallic poisons, it has been claimed that the use of vitamin C will reduce the incidence of such poisonings. These claims are still unproved. If industries with such hazards wish to try vitamin C they should do so with the knowledge that the matter is still in the experimental stage, and they should not be lulled into a feeling of security and thereby relax other proved safeguards.

The broad conclusions which the Council on Foods and Nutrition and the Council on Industrial Health make are: (1) The decision to give vitamins to industrial workers should depend on the results of a careful study of each particular situation. (2) If vitamin deficiency can reasonably be demonstrated supplementation of the diets with vitamins may be rational, but, once adequate nutrition is restored and an adequate diet provided, supplementation with vitamins serves no useful purpose. (3) The money spent by industrial concerns in the purchase of vitamins would probably be more wisely spent on the education of workers in the selection of a good diet.

FRANK G. PEDLEY

Immunity and Positive Tuberculin Reaction. Brahdy, L.: *Am. J. Pub. Health,* 1941, **31**: 1040.

In this article the incidence of tuberculosis among two groups of nurses is discussed. The first group consisted of 1,320 nurses who were tuberculin-positive at the time they commenced their training, but who showed no x-ray evidence of active disease. The second group consisted of 910 nurses who were tuberculin-negative. In other respects, including their occupational exposure, the two groups were similar.

Among the tuberculin-positive group 6 lesions developed (5 parenchymatous and 1 pleurisy with effusion) 0.5%. Among the tuberculin-negative group 34 lesions developed (28 parenchymatous and 6 pleurisy with effusion) 3.7%.

The author interprets these results as evidence against the exogenous reinfection theory. He believes that the 6 cases of tuberculosis in the tuberculin-positive group were endogenous. He draws other conclusions as follows:

"Doctors, nurses, attendants and students who are tuberculin-positive need not fear tuberculosis because of their work. A tuberculosis patient is not a source of infection for adults of his family who are tuberculin-positive reactors. In hospitals and sanatoria there is no evidence that tuberculous patients infect one another. An ex-patient may be employed by a tuberculosis hospital with safety to himself as far as activating his own lesion or acquiring new infection is concerned. A program for the prevention of tuberculosis among nurses or any other group must start and also end with prevention of infection of tuberculin non-reactors."

FRANK G. PEDLEY

Sensitivity to Coccidioidin Among Boys in an Eastern Preparatory School. Aronson, J. D. and Gallagher, J. R.: *Am. J. Pub. Health,* 1942, **32**: 636.

Tuberculosis surveys of school children frequently reveal a small but significant percentage of persons who fail to react to tuberculin of proved potency but who show on roentgenological examination calcified nodules characteristic of healed pulmonary tuberculosis. Recent studies suggest that in some cases these calcified areas may represent infection by *Coccidioides immitis.*

The authors studied the students of a preparatory school in the eastern part of the United

States in regard to their reaction to tuberculin and coccidioidin. There were 680 students tested. Most of them were about 17 years of age and 80% came from the eastern States; 17 students reacted positively to coccidioidin (2.5%). Eight of these reactors showed calcified pulmonary nodules by x-ray and 5 of the 8 gave a negative tuberculin reaction. In these 5 cases, therefore, it is reasonable to suppose that the calcified nodules may have been the residue of a coccidioides infection. Only 2 of the 17 reactors to coccidioidin gave a history suggestive of coccidioides infection.

FRANK G. PEDLEY

Obituaries

Dr. Harold Egbert Alexander. Never has the profession of Saskatoon and of Saskatchewan been so shocked as when in the evening of October 5th, word was spread that Dr. Harold Alexander had died suddenly about 5 p.m. while on a load of wheat which had drawn up beside his threshing outfit on his extensive farm about twenty miles north east of the city. After his day's work in hospital and office, as was his custom he drove out to see how harvesting was progressing. He climbed up on a load, pitched a few sheaves, and passed to the great beyond before he could be lifted down.

Dr. Alexander was born at Fredericton, N.B., July 31, 1884. He was educated in New Brunswick, graduated from Toronto University (1910), followed by two years in the New York Post-Graduate Hospital, coming to Canada in 1912 and beginning practice in Saskatoon. In 1913 he married Edith Begg, of Blenheim, Ont., who survives him. He leaves also two sons, Robert and William, and two daughters, Dr. Margaret of the staff of the Toronto General Hospital, and Miss Doris.

From 1912 to 1924 he built up one of the largest practices in Western Canada. He had a genial personality and untiring energy, and was ever in the forefront in adding to his armamentarium by attendance each year at the leading medical conventions both in Canada and the United States. In pursuit of advance, especially in surgery, he took the degree of F.R.C.S. of Edinburgh in 1925 and also shortly after was elected to the F.A.C.S. Returning from the old country in 1926, during the next sixteen years he devoted himself mainly to surgery, and at the time of his death could be ranked as one of the foremost surgeons of Western Canada.

He was a man of splendid physique, and his delight was work whether in the study, in the hospital or on his very large farm which lay along the south bank of the South Saskatchewan. Here he experimented in growing grains, alfalfa and other crops. Here he fed cattle for the English market, and his latest and greatest farming achievement was seen in the splendid group of pure bred Belgian horses, which he raised on the farm. It is enough to say that he was able to take the high prizes at the Toronto horse shows a few years ago. These splendid horses were seen at all the exhibitions around, as well as even in the Chicago Horse Fair. Such was the man who at the early age of fifty-eight was suddenly cut off from his work and called to his reward.

J. A. VALENS

Dr. Roy Armstrong Bond, a medical practitioner in Toronto for the past twenty-seven years, died on November 9th, at his home, following a prolonged illness. He was 59 years old.

Dr. Bond was born in Tottenham, Ont., in 1883 and received his education at Winchester Street and Rhodes Avenue Public Schools, Toronto, and the Ontario College of Pharmacy. He graduated in medicine from the University of Toronto in 1915, and established a practice in Toronto in the College-Yonge Streets district.

Dr. Samuel V. Carmichael, of Strome, Alta., passed away on October 27, 1942, from a heart lesion. He graduated from Queen's University in the class of 1908, and in the summer of 1910 he passed the Alberta Provincial examination, but it was not until October 27th of that year that he registered, so he practised in Alberta 32 years to a day. He was 60 years of age.

Dr. Norman Carter, a graduate in medicine of the University of Toronto in 1941, died on October 8, 1942, at St. Michael's Hospital, where he had been a patient for the last month. He had just celebrated his thirty-third birthday.

After his graduation Dr. Carter was an intern at St. Michael's Hospital. Last May, after being rejected for service in the army, he went to Sudbury, where he joined the staff of International Nickel Company of Canada Limited as physician. Taken ill in September, he returned to Toronto for treatment.

Dr. Carter was born in Prince Edward County and lived in Brantford for some years. At the age of 11 he moved to Detroit with his parents and attended local public and high schools. He trained as an air pilot, and was for a time associated with a United States passenger air line. Returning to Canada in 1931, he entered the University of Toronto two years later.

Dr. Martin F. Cashin, of St. John's, Newfoundland, died suddenly in his office on November 5, 1942. He was forty-three years of age. Born at Cape Broyle, Newfoundland, the son of the late Sir Michael Cashin and Lady Cashin, he received his early education at St. Bonaventure's College, St. John's, later entering McGill where he graduated in medicine with high honours in 1924. He was a Cooper Research Fellow in Experimental Medicine. For the last ten years Dr. Cashin has practised in St. John's, confining his professional work to internal medicine.

W. J. COCHRANE

Dr. Albert Downing, a leading physician of Carleton Place, Ont., for the past 28 years, died at his home on October 16th, after four days' illness.

Son of the late John H. Downing and his wife Margaret Anderson, he was born in Elora, Ont., on February 16, 1874, and completed his early education in that town. He graduated from the University of Toronto Medical School in 1895. At the age of 21 years he began medical practice at McDonald's Corners, Ont. In 1903 he married there the former May Anderson, who, with one son Robert A., barrister of Carleton Place, survives. The same year he went to Bruce Mines, Ont. Later he took up practice in Lanark, Ont. In 1914 he came to Carleton Place.

Prominent in the affairs of the town he had served as a member of the Board of Education for a number of years and as Deputy-Reeve. At the time of his death he held the position of Medical Officer of Health for Carleton Place. He was appointed a coroner for the County of Lanark while practising at McDonald's Corners and continued to serve in that capacity during his residence in Carleton Place.

During the summer of 1940, when over twenty English war guests arrived at various homes in Carleton Place, Dr. Downing kindly offered his services free for the care of these children, their mothers and guardians. He expressed himself as considering it a privilege to take care of them as part of his war effort.

J. A. JOHNSTON

Dr. Robert Bruce King died at Newborough, Ont., on October 17, 1942. He was a graduate of the University of Toronto of 1893.

Dr. John J. MacKiggan died at his home in Donkin, Nova Scotia, after a long illness. He was fifty-one years of age. Dr. MacKiggan was a native of McNabb's Cove, Richmond County, and a graduate of Dalhousie Medical School in 1921. After working with the late Senator

John A. MacDonald, M.D., St. Peters, for six years, he became an associate of Dr. W. W. Patton in the colliery district of Glace Bay. Twelve years ago he succeeded Dr. Patton and served to the time of his illness.

Dr. Sara Meltzer, Associate Pathologist of Winnipeg General Hospital, died October 11th in the hospital where she had worked for eighteen years.

Born in Winnipeg in 1900 she studied in St. John's Technical School and Manitoba Medical College from which she graduated in 1924. She then joined the pathological department of the Winnipeg General Hospital where she continued without interruption save for post-graduate work under Dr. Masson, University of Montreal, and Dr. James Ewing, Cornell Medical School, New York. Under Professor William Boyd and Professor Daniel Nicholson her reputation as a tissue pathologist and teacher steadily rose. In 1937 she was appointed lecturer in Pathology in the Faculty of Medicine, University of Manitoba, and Associate Pathologist, Winnipeg General Hospital. She also lectured for many years to the student nurses of the hospital. She is survived by her father, three sisters and four brothers, three of whom are in the Canadian forces, and one of whom, Capt. Herbert Meltzer, R.C.A.M.C., formerly surgeon at Manitoba Sanatorium, Ninette, is now serving overseas.

By herself and with other members of the staff Dr. Meltzer published papers on rheumatic fever, thyroid disease, relation of neurological lesions to gastric ulcer and findings in experimental tar cancer.

Dr. Sara was beloved for her qualities of mind and heart. Her untimely death is a real loss to the hospital and the college.

AN APPRECIATION

Dr. Sara Meltzer, assistant pathologist to the Winnipeg General Hospital and lecturer on pathology in the University of Manitoba, died on October 11th. From 1924 to 1937 she was associated with me in hospital work and in teaching.

It is difficult to give anyone not connected with the Winnipeg Medical School an idea of what Sara Meltzer meant to those who had the privilege of working with her, and to the countless students with whom she came in contact. Her professional abilities were of the highest, and when a clinician received her opinion on pathological material he was so completely satisfied that he never felt it necessary to consult the head of the department nor any outside authority, however illustrious. As a teacher of small groups of students and interns she was unrivalled, because she brought to the task a vivid enthusiasm and keenness of intellect which left an indelible imprint on the young.

But it is not her ability as a pathologist that accounts for the terrific feeling of loss which all who knew her experience at the present time. It was greater and deeper qualities that gave her the power to influence those with whom she came in contact. Her eager delight in life, her zest and fun, her love of all that was best in music and literature, her absolute devotion to those things that are lovely and true and honourable, so that it was impossible for one even to dream of her doing anything that was mean or unworthy, her charm and her sympathy for the unfortunate, these are the things which made Sara Meltzer what she was, and which gave her a personality that was unique.

When all this has been said there remains something which cannot be imparted nor transferred to paper. In the words of an editorial which appeared in the *Winnipeg Free Press* at the time of her death, she bound men and women to her with hoops of steel forged in the furnaces of love, affection and intellectual respect.

WILLIAM BOYD

Dr. Harold Campbell Parsons, of Toronto, for forty-one years physician in charge of the chest clinics at the Toronto General Hospital and the Hospital for Sick Children, died on October 15, 1942. He was in his seventy-fourth year and had been retired because of ill health for several years.

Dr. Parsons served in the first Great War with the Canadian Army Medical Corps, both in Salonika and England. He was a former physician-in-chief and active in the founding of the I.O.D.E. Preventorium for Children. He was for many years on the staff of the University of Toronto.

Born in Toronto, Dr. Parsons was the son of the late Benjamin Parsons of Thornhill and Mary Campbell Parsons, of Brockville. He graduated in arts from Trinity College in 1891 and the following year received the degree of M.D. from the University of Toronto. After serving a year as house physician at the Toronto General Hospital he held the position of house physician from 1893-96 for the late Sir William Osler, Johns Hopkins Hospital, Baltimore, Md. He spent several years in post-graduate study in Germany and England and received his M.R.C.S. and L.R.C.P. In 1898 he was appointed lecturer on the staff of the Women's College Hospital and Trinity Medical College and in 1906 became assistant physician of the University of Toronto.

Returning to Canada after the war, Dr. Parsons became medical consultant on the staff of Director of Medical Services for Canada. From 1920 to 1924 he was medical consultant for the Department of Soldiers' Re-establishment. In 1936 he was elected a Fellow of the Royal College of Physicians, London, Eng.

Dr. Robert Hopkins Paterson, of Hamilton, Ont., well-known physician, died suddenly at his home on November 6th after a heart attack. He was born in 1883. Since 1920 he has been in charge of special clinical work for the Department of Health with headquarters at the General Hospital.

Dr. Paterson graduated from the University of Toronto in 1908 and served with the C.A.M.C. during the last war as Captain.

He was well known in the Masonic Order.

Dr. Arthur Wycliffe Scott, of Calgary, died in Weston, Ontario, October 19, 1942, at the age of 41 years. He was the son of Dr. A. Melville Scott, for many years Superintendent of the Calgary Schools. He was born in Fredericton, New Brunswick, and came to Calgary in 1906. He received his public and high school education, as well as his Normal School training in Calgary. He taught school for a while, then attended Toronto University, where he took his B.A. in 1924 and his M.D. in 1927. He was a brilliant member of his class. After an internship at Wellesley Hospital, Toronto, he practised in Calgary and Banff until 1941, when he went east. He leaves a wife to mourn his loss.

Dr. James C. Shanks, of Toronto, died on September 17, 1942, in his ninetieth year. He was well known in Howick, Que., and throughout the Chateauguay Valley, and was closely associated with *The Gleaner* in the earlier days. He was born in Huntingdon, Que., on January 2, 1853. He attended Huntingdon Academy, graduating from there in 1869, and became a machinist in the Gillis & Boyd machine shops where he remained for three years. For two years he worked with the Gilbert's Machine Engine Company on the Lachine Canal, where James Howden was foreman and James King, chief draughtsman. These two men came from St. Louis de Gonzague. Dr. Shanks was with Howden when the side wheeler beam engine was installed in the *St. Francis*. It was this boat that was built to compete with the *Bohemia*, running between Cornwall, Port Lewis, Valleyfield and Montreal, on account of the high rates charged for freight. Alex. Anderson, son of Laird Anderson, Huntingdon, was the main promoter. Dr. Shanks later matriculated before the board of examiners and became assistant with first engineer, Charles Scott, who came from St. Timothée, on a boat running between Montreal and Port Dalhousie, on Lake Ontario. In the following year he received a higher certificate and took charge as engineer on a tug boat on the St. Lawrence channel above Sorel, Que.

Later he purchased a drug store in Huntingdon and dispensed medicine two years under the late Dr. Alex. Cameron. He entered McGill University and graduated in medicine in 1881. When Dr. Shanks graduated he settled in Howick where he practised until 1932.

Therefore, during his many years of faithful service, it can be truthfully said, he saw many come into the world, and knew the various families from one generation to another. It can be said he knew more about the health and heredity of families, much better than the families themselves, for he had cared for several generations.

He was a member of the District Medical Society; local health officer and physician for the Grand Trunk and later C.N.R. employees, examiner for the I.O.F. and many insurance companies. He was also a member of the McGill Graduate and Medico-Chirurgical Societies of Montreal.

Until the time of his death, the deceased had lived in Toronto, at the home of his son Major G. Shanks, I.M.S.

His name will live in the memories of the people of Chateauguay Valley for years to come and his work and devotion will serve as an everlasting memorial to the district he so faithfully served.

Dr. David King Smith, of Toronto, prominent as a physician and dermatologist, died, November 3, at his home, in his seventieth year. He had been in ill health for some time and retired ten years ago. He was a veteran of the first Great War. Dr. Smith was born in Toronto, the son of the late Dr. Andrew Smith. He received his education at the Model School, Jarvis Collegiate, the Medical School of the University of Toronto and did postgraduate work in London, England, and in New York City. He won recognition as a dermatologist in Europe and the United States, as well as Canada, and from 1912 to 1923 was in charge of the clinic for diseases of the skin, Toronto General Hospital.

For a time medical officer with the 48th Highlanders, Dr Smith later became lieutenant-colonel in the Canadian Army Medical Corps. He also served with No. 4 Canadian General Hospital in England and Salonika, Greece. Later he was appointed officer commanding the Davisville Military Hospital.

Dr. Smith was president of the Toronto Academy of Medicine in 1930. He was a former associate professor of medicine at the University of Toronto.

Dr. Roy James Snider, of Thessalon, Ont., died on September 20, 1942. He was born in Toronto in 1892, of United Empire Loyalist stock, the son of the late Dr. R. O. Snider and Annabel Weir Snider. He graduated from the University of Toronto (1916). Immediately upon graduation he went overseas with the C.A.M.C. as Lieutenant, transferring to the R.A.M.C. as Captain in 1917.

He went to Salonica in August, 1916, with Number 41 General Hospital and Number 66 Field Ambulance.

In September, 1917, he went to Mesopotamia as medical officer with the 116th Mahratta Light Infantry. He went to India and France in September, 1918, and was wounded at Cambrai, September 23rd of the same year.

Following the Armistice he was medical officer on a transport bringing prisoners of war back from Germany to England. He remained in the regular army as M.O. with the Devonshire Regiment and served in that capacity during the "Sinn Fein" rebellion, being stationed at Bantry Bay in the South of Ireland.

Dr. Snider returned to Canada in 1921 and was an intern in the Toronto Western Hospital for two years, after which he established practice at Bruce Mines, Ont., moving to Thessalon, Ont., in 1925 where he remained until his death.

In 1928 he married Anne Laidlaw Nelson who survives him.

A life of service was brought to a close by the passing of the late Dr. Snider. He will be greatly missed in Thessalon and throughout the whole surrounding district where he won by his skill and devotion to duty the respect and gratitude of numerous patients. Dr. Snider was an exceptionally clever surgeon and upheld the high honour of his profession on all occasions. Friends and admirers will long remember the humanitarian activities in which he engaged during his practice in Thessalon and his passing at a comparatively early age is widely mourned.

News Items

Alberta

The Council of the College of Physicians and Surgeons was called to meet in Calgary on November 18, 1942, when among the matters to be discussed was the question of the relationship of the work of the Procurement and Assignment Committee to that of the caring for of the civilian population in Alberta. At the present time there are 80 general practitioners in Calgary, 48 of whom are over 55 years of age; there are 94 general practitioners in Edmonton, and 48 of them are over 55 years of age. In speaking of general practitioners, we refer to those who are in private practice, though they may be specializing in some different departments. In the Province at large, outside of these two cities, there are 206 physicians in private practice and 100 of these are over 55 years of age. Alberta is a province of distances, and in many cases rural practitioners are 40 miles from their nearest medical neighbour.

The Eugenics Board of Alberta has issued a report for 1941. During this year, 77 operations were performed, making a total of 805 since the commencement of its work in 1929. There were, however, during the same period 1,692 cases reported on.

In the Province of Alberta there are, at the present time, 69 physicians connected with the Air Force, and 39 with the Army. It has been suggested that owing to a shortage of physicians in private practice, the College of Physicians and Surgeons should grant temporary licenses to the medical men in the forces, permitting them to treat civilians in case of need. It would appear to be necessary to have an amendment to the Medical Act to give the Council this authority. While an Order in Council by the Government can stay the action of certain laws, an order cannot be issued to give the Council new powers not already covered by the Act.

A Committee of the Legislature is still busy investigating the operation of the Workmen's Compensation Board, and, so far, have made no report. The employers are resenting the suggestion that the cost to them be increased to provide for further benefits to the workmen, and state that business will not permit the extra cost.

A great injustice is being done city physicians, especially in the larger areas, where rural municipalities contract with hospitals for the care of their patients, but make no provision for the payment of services of the doctors who must look after them. While it is not permissible for hospitals to make a rate for doctors' services, it is contended that hospitals should not make contracts with rural municipalities without the said municipalities having made some arrangement for the medical care of the patients.

It has been suggested that some steps be taken so that when a doctor returns from his service in the Forces, his practice may be handed back to him. How this can be worked without an injury to the supplying doctor has not yet been made clear.

In our last item, an error was made in reporting certain appointments of the Alberta University Staff. Dr. J. Ross Vant, M.C.O.G., becomes head of the Department of Obstetrics and Gynæcology, and Dr. J. O. Baker, M.C.O.G., F.R.C.S.(C), F.A.C.S., who was associate professor, becomes Professor of Gynæcology and Obstetrics.

G. E. LEARMONTH

Manitoba

Dr. and Mrs. J. W. Cartmell, of Glenboro, celebrated their fiftieth wedding anniversary at their home on October 5th. Since graduating from Manitoba Medical College in 1891, Dr. Cartmell has practised continuously at Glenboro, and for ten years he was reeve of the municipality of South Cypress, while Mrs. Cartmell devotes much of her time to Red Cross work. Manitoba congratulates these worthy citizens.

The inaugural meeting of the Board of Manitoba Medical Service was held in the Medical Arts Building on October 9th. Dr. R. M. MacCharles was elected chairman and Dr. Hugh Cameron, secretary. The Board consists of 15 members of whom 8 are medical men. The solicitor, W. C. Hamilton, K.C., reviewed the draft of the agreement between Manitoba Medical Service and Manitoba Hospital Service Association which will act as agent for Manitoba Medical Service in obtaining business, collecting and disbursing moneys, etc., and the draft of contracts between subscribers and the corporation and between medical members and the corporation. Manitoba Medical Service has been incorporated by the Manitoba legislature. A meeting of the medical profession of Winnipeg will be held shortly at which the schedule of fees will be presented for discussion.

ROSS MITCHELL

New Brunswick

The Regular monthly meeting of the Saint John Medical Society was held in the Nurses Home of the Saint John General Hospital. Major Ferguson, from Camp Sussex Military Hospital, was special speaker. His subject was "Atypical pneumonias". At present this is a most interesting clinical study and Major Ferguson's address was very timely.

The 2nd 14th Field Ambulance, R.C.A.M.C. heard two addresses at one of the regular parades in October. Lieut.-Col. J. P. McInerney, recently returned from England, spoke on Field Ambulance functions in war under three headings: 1st, during an advance; 2nd, during a retreat, and 3rd, in fixed positions. Major Paul Melanson lectured on camouflage or, more particularly, personal concealment. These addresses were most interesting due to the fact that both these R.C.A.M.C. officers have had personal experience overseas in the present war.

In a recent issue of the *Royal Gazette*, Dr. R. A. Massie and Dr. R. D. Smith, both of St. George, were apointed coroners.

A New Brunswick physician, Surg. Lieut. A. W. Clark, of Saint John, has been awarded the Distinguished Service Cross. Surg. Lieut. Clark previously practised in Sussex, N.B. He joined the R.C.N.V.R. September, 1940, and has been in service with the R.N. since October of that year. Twice he served on ships of the R.N. when they were torpedoed and sunk. He is at present stationed at an eastern Canadian port.

A. STANLEY KIRKLAND

Nova Scotia

Dr. T. C. Lockwood, of Lockeport, celebrated his 85th birthday on October 9th. In 1881 he graduated in Arts from Mount Allison. In 1885, after spending three preliminary years at the Halifax Medical College, he graduated from Bellevue Hospital. After interning at the Victoria General Hospital he went to Lockeport in 1887. For fifty-five years he has watched over the physical welfare, and often the moral, of the fishing and lumbering folk. For thirty years, as port physician, he watched the schooners off on their run to the banks, watched their long beat back, well laden. For thirteen years he was mayor of Lockeport. He will still drive to you, if you are sick, over the sand bar, the surf roaring in his keen ears, and minister to you from the many years of his experience.

Lieut. R. W. Begg (Dal. Medicine '42), who wanted to go immediately to Libya on graduation, and could not, has joined a parachute battalion and gone to a United States Army Camp for parachute training.

Dr. R. Evatt Mathers, Halifax, was elected Vice-President of the Canadian Ophthalmological Society at the annual meeting, in Montreal.

A total of 236 fleas were found on 272 rats shot and trapped on the garbage dump and waterfront of Halifax, an average of 0.867 fleas per rat. Not enough to be very itchy, this did cause a bit of head scratching in the Dominion Department of Pensions and National Health who, .22 rifle and rat trap in hand, made the survey. Of the 236 fleas—a small count compared with other coastal towns—only four were of the type that could carry bubonic plague. This was a useful and comforting report to the epidemic conscious Halifax populace. Also comforting, somehow, was the information that the rats were of the brown Norwegian variety—a pure Nordic strain. Last major visitation of the plague to Halifax was in 1866 when the barque *England* put into port with her holds and cabins full of dead and dying immigrants. Quarantining saved the city, but Dr. Slayter died in the service of the sick; and the beginning of the Halifax Infirmary was made by the Sisters of Charity.

Dr. W. Edward Murray (Dal. '37) has been appointed to the staff of the Lockwood Clinic, Toronto, in Medicine.

ARTHUR L. MURPHY

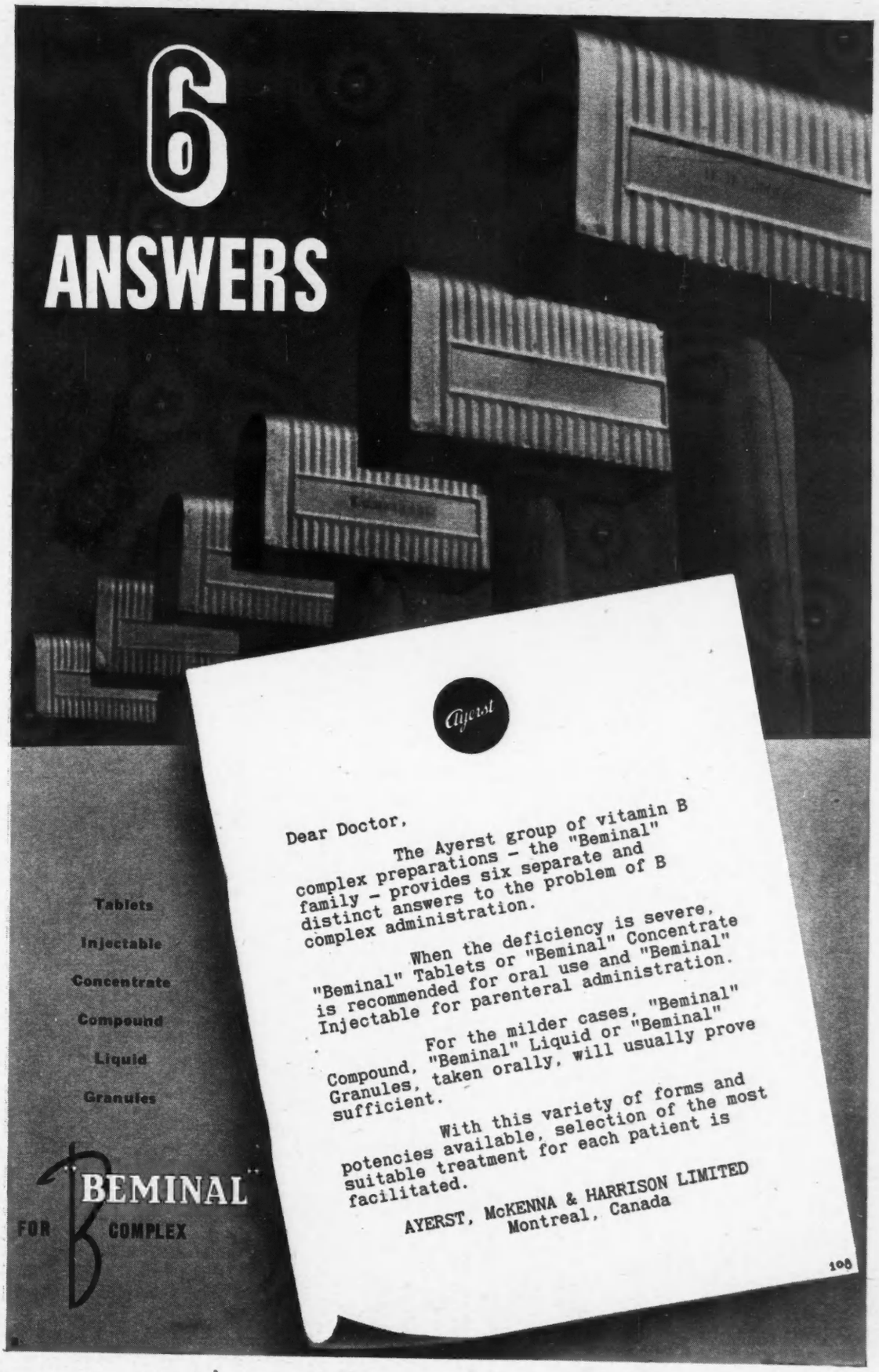
Ontario

Following a canvass of the live stock owners in Dufferin County, the Dominion Department of Agriculture is now testing all the cattle in Dufferin County for tuberculosis. So far, it was reported that 1.5% of the animals in two townships reacted to the test. When every herd has been tested the County will automatically become a restricted area under the Health of Animals Branch, Department of Agriculture. Three of Dufferin's neighbouring counties, Peel, Simcoe and Grey, are now restricted areas.

The Department of Pensions and National Health has instructed Mrs. Olive Whillans, a graduate of the Department of Occupational Therapy of the University of Toronto, to organize occupational therapy in the hospitals of the Department at Toronto, London, St. Anne de Bellevue, Halifax, Saint John, Winnipeg, Calgary, and Vancouver. The groundwork of the scheme will be laid at Christie Street Hospital. Mrs. Whillans was formerly in charge of the workshop of the Toronto Branch of the Occupational Therapy Association, and later organized occupational therapy departments of the Workmen's Compensation Board of Ontario.

Dr. Evelyn Fleming, on furlough from her hospital at Nasik, India, was the guest of honour at the University Women's Club last month where she gave an account of her experiences as a woman surgeon working in a country district in India.

The medical profession of Toronto, through the Academy of Medicine, has been in conference with the Board of Control regarding the problems arising out of the shortage of doctors in civilian practice due to the large numbers now serving with the forces.


6
ANSWERS
Ayerst
Dear Doctor,
The Ayerst group of vitamin B complex preparations – the "Beminal" family – provides six separate and distinct answers to the problem of B complex administration.
When the deficiency is severe, "Beminal" Tablets or "Beminal" Concentrate is recommended for oral use and "Beminal" Injectable for parenteral administration.
For the milder cases, "Beminal" Compound, "Beminal" Liquid or "Beminal" Granules, taken orally, will usually prove sufficient.
With this variety of forms and potencies available, selection of the most suitable treatment for each patient is facilitated.
AYERST, McKENNA & HARRISON LIMITED
Montreal, Canada
108
Tablets
Injectable
Concentrate
Compound
Liquid
Granules
FOR B COMPLEX
"BEMINAL"

The statement was made that of 1,216 doctors resident in Toronto, of whom 200 are interns, 300 have already joined the armed forces. Acting in the matter is a committee on which are representatives of the Ontario Medical Association, Ontario Department of Health, Canadian Medical Association, College of Physicians and Surgeons, Academy of Medicine, and the City's Department of Health. Other problems were discussed such as preparation for air raids, possible epidemics, and preparations necessary for the quick conversion of buildings to provide hospital accommodation should sudden demand arise.

Mrs. Harvey Agnew, of Toronto, President of the National Council of the Y.W.C.A. and wife of the Associate Secretary of the Canadian Medical Association, has been named to supervise the housing program of the Consumer Branch of the War Time Prices and Trade Board. The program of the Board will include a campaign to persuade householders to make unoccupied housing space available to those who require it.

In June an Order-in-Council was passed permitting women physicians to enlist in the R.C.A.M.C. The first class of fifteen began study early in November, the course being carried out at Camp Borden, the first such training camp for women doctors accepted by the R.C.A.M.C.

The many friends of Dr. R. G. Agnew, well-known Toronto United Church Missionary to China, will be pleased that, although he sustained severe injuries several weeks ago while riding his bicycle between Chungking and Chengtu, a recent cable states that his infected wounds are clearing and he is on the road to recovery.

The Ottawa Civic Hospital is reported to be making a request to be allowed to adopt a policy of refusing admission to hospital of any but emergency and maternity cases after 4.00 p.m. each day in an effort to alleviate conditions arising from a shortage of trained hospital workers. The Provincial Department of Health reported such conditions as rather general, and that they were under constant consideration.

Dr. Arthur W. M. Ellis, son of the late Professor W. H. Ellis of the University of Toronto, and himself a graduate of the University in 1906 in Arts and in 1908 in Medicine, has been appointed Regius Professor of Medicine in Oxford University, the chair occupied during the last war by another eminent Canadian, Sir William Osler, and now made vacant by the retirement of Sir E. Farquhar Buzzard, Bart. Dr. Ellis served with the Canadian Corps during the last war. In addition to his many other appointments, he is Director of the Research in Industrial Medicine under the Research Council of Great Britain.

Eighteen semi-private beds will be provided by the proposed new addition to the St. Catharines General Hospital. It will also contain two major operating rooms.

Dr. W. E. Gallie, Professor of Surgery and Dean of the Faculty of Medicine of the University of Toronto, has been elected to Honorary Fellowship in the Royal Society of Medicine.

The two separate Health Service Departments for men and women in the University of Toronto have been combined this year to form the University Health Service with Lt.-Col. R. W. I. Urquhart as Director. Dr. Gwen Mulock is Assistant Director in charge of the women's division.

The Health Service now provides an annual physical examination for all undergraduate students. All are tuberculin tested. X-rays of the chest will be taken of all first year students, and of others where indicated.

Infirmary quarters for students living in residence or lodgings are now in the course of preparation; the men will be cared for in Hart House and the women on the top floor of the Women's Union at 79 St. George Street, through the kindness of University College. This service is intended only for those who are suffering from minor illnesses which require bed care for a few days to a week. It will not be available for serious illnesses requiring hospitalization or for students living at home.

Health Service officials also announce that a certain amount of financial assistance will be extended to students injured while engaged in athletic activities, this assistance to be provided on the recommendation of the Director.

Consultation facilities and provision for first aid will be available as in the past at the two Health Service buildings; for men at 43 St. George Street and for women at 44 Hoskin Avenue. First aid will also be provided at Hart House from 4 to 6 daily.

Lt.-Col. Kenneth A. Hunter, of London, was mentioned in despatches following the Dieppe Raid. He was Officer Commanding, Second Canadian Light Field Ambulance.

Captain A. F. Graham, R.C.A.M.C., who had been awarded the Military Cross for distinguished service in the Middle East, is reported a prisoner of war in Libya, having been captured at Tobruk. Captain Graham is the son of the late Dr. Jos. S. Graham, and grandson of Dr. Jas. E. Graham, former Professor of Medicine, University of Toronto.

Lt.-Col. G. L. Morgan Smith, R.C.A.M.C., has been mentioned in despatches.

Captain G. F. R. Parker, R.A.M.C. (Toronto '35), formerly missing in Libya, is now reported a prisoner of war.

The Faculty of Medicine, University of Western Ontario, is also proud of the fact that Lieutenant William Ewener, of Sarnia, a former student in medicine, was awarded the Military Cross following the Dieppe Raid.

Headquarters of Military District No. 1 has announced the personnel of No. 10 General Hospital, one of the largest medical units of the Canadian Active Army. It will be a 1,200 bed unit commanded by Colonel H. P. Hamilton, of Kitchener, recently returned from overseas. The Chief of the Medical Service will be Captain J. H. Geddes, and of the surgical division, Lt.-Col. J. C. Wilson. The staff includes Captain P. P. Hauch, Preston; Captain J. T. Biehn, Sarnia; Captain H. T. Norry, Woodstock; Captain H. H. Chace, Kitchener; Captain H. A. Cave, Montreal; Captain J. E. Williams, St. Mary's; Captain A. M. W. Borrowman, Sarnia; Captain J. H. Beattie, Clinton; Captain C. A. Stewart, Chatham; Captain F. S. Brien, Windsor; Captain J. H. Fisher, London; Captain R. A. Johnston, London; Major C. C. Ross, London; Captain W. L. Denney, London; Captain A. D. McLachlin, St. Thomas; Captain W. W. Riddolls, Brantford; Captain F. S. Babb, London; and Captain R. C. Rider, Toronto.

Lt.-Col. M. D. Graham, E.D., of Ottawa, who has recently returned from overseas, has been given command of the Rideau Military Hospital. First commissioned in the C.A.M.C. in 1914, he served at the Military Hospital at Petawawa and afterwards on numerous Army Medical Boards. After the Armistice he continued with the militia and as Lieutenant-Colonel commanded the 23rd Field Ambulance from 1937 on. He commanded the 23rd Field Ambulance overseas in this war until his recent return to Canada.

FROM WHATEVER ANGLE YOU LOOK AT IT

Looking at Alka-Zane from every viewpoint of clinical application, one can readily see how well it fills the role of a well-balanced systemic alkalizer.

Sodium, potassium, calcium, and magnesium in Alka-Zane are supplied in the readily assimilable form of citrates, carbonates, and phosphates. And it is worth noting that one dose of Alka-Zane affords as much basic calcium as do 12 grains of calcium lactate or 18 grains of calcium gluconate.

Alka-Zane makes a zestful and refreshing drink. Its pleasing taste is especially appreciated when palatability counts most, as in the "morning sickness" of pregnancy. Why not observe the usefulness of Alka-Zane in this, as well as other conditions requiring an alkalizer, by giving it a trial? We shall gladly send a supply if you will write a request on your letterhead. Alka-Zane is available in bottles of 4 ounces.

ALKA-ZANE

WILLIAM R. WARNER & COMPANY, LTD. • 727 King Street, W., Toronto, Ont.

Lt.-Col. R. M. Harvey, R.C.A.M.C., Officer Commanding, No. 2 Casualty Clearing Station, Overseas, has been promoted Colonel in command of No. 15 General Hospital. J. H. ELLIOTT

Quebec

For more than ten years the Ministry of Health has furnished convalescent serum for treatment of poliomyelitis to physicians requesting it. The expense incurred in the preparation of this biological product was justifiable, because it was considered that the serum might offer a means of reducing the damage caused by the disease.

Meanwhile sero-therapy has been submitted to the test of time throughout the world, and public health authorities today are unanimous in acknowledging that patients treated with the serum present no significant indications of recuperation different from those of patients who have not been so treated.

Some physicians still believe that administration of the serum may be, in some way, helpful; and the family of the patient has the impression that something is being done to prevent the dreaded paralysis. But these considerations are of a sentimental or psychological nature which cannot be sustained in the light of scientific study.

By reason of its experience of this method of treatment, the Ministry of Health believes itself no longer justified in spending the considerable sums involved in the preparation of the serum, and is therefore discontinuing its distribution.

La suggestion du nouveau président de l'Association des Médecins de langue française de consacrer le prochain congrès de cette société à l'étude de la médecine préventive et de l'hygiène a provoqué d'élogieux commentaires de la part de l'honorable Henri Groulx.

Voici ce qu'il a dit:

"En ma qualité de ministre de la Santé et du Bien-Etre social, dit Mr. Groulx, il m'est impossible de laisser passer cette occasion sans féliciter nos médecins de cette belle initiative. Les paroles du Dr. Charles Vézina, lors du congrès, méritent plus que des félicitations. Nous aurons fait un grand pas dans la voie du progrès quand le vœu du docteur Vézina sera accompli.

"Le devoir de préserver la santé n'incombe pas seulement à l'Etat, a-t-il dit, mais aussi aux médecins. Nous voudrions que nos médecins soient des apôtres de l'hygiène et de la médecine préventive dans les milieux où ils exercent leur profession. Ce sont là deux souhaits conformes aux aspirations de tous les hygiénistes de mon département," continue le ministre. "Le collaboration des médecins praticiens avec les fonctionnaires du ministère de la Santé et du Bien-Etre social, à mesure qu'elle augmentera, donnera certainement une impulsion de plus en plus considérable à l'hygiène et à la médecine préventive.

"L'importance de l'hygiène a été soulignée récemment par le ministre de la Défence nationale quand il a révélé que sur 50,000 jeunes qui avaient offert leurs services, 30,000 seulement avaient été acceptés. Les autres, dit-il, étaient des gens mal alimentés ayant de mauyeux et l'ouie défectueuse, les dents cariées ou absentes ou avec un poids au-dessous de la normale.

"Le gouvernement de la province de Québec n'a pas attendu les résultats des examens médicaux imposés aux futurs militaires pour créer un organisme destiné à répandre, parmi ses administrés, de justes notions sur l'alimentation. La collaboration des médecins praticiens, dans ce domaine comme dans toutes les autres branches de la prévention, sera d'un grand avantage pour la province.

"Le docteur Vézina a parfaitement raison de proclamer 'qu'un congrès où seraient étudiées la mortalité maternelle et infantile, l'hygiène alimentaire, l'hygiène industrielle et scolaire, la pasteurisation du lait, qui fait couler beaucoup d'encre dans notre province,' pourrait rendre de grands services à la profession médicale et à notre population.

"Enfin, les pouvoirs publics, quant ils sont appuyés par les membres les plus éminents de notre élite, peuvent adopter beaucoup plus facilement les mesures indispensables au salut public tout en bénéficiant de la clairvoyance et de connaissances de leurs collaborateurs." JEAN SAUCIER

Saskatchewan

Dundurn Military Hospital was the scene of the première of the documentary film on cancer made under the auspices of the Saskatchewan Provincial Department of Health, entitled "That They May Live".

The medical assembly of R.C.A.M.C., M.D. 12, was held with the permission of Lt.-Col. R. A. Hughes, D.M.O., E.D.; arrangements were made by Major Findlay, O.C., and officers of Dundurn hospital. About 80 members of the Saskatchewan Medical Association attended. Special guests included Hon. J. M. Uhrich, minister of public health and members of the Saskatchewan Medical Association.

Col. Hughes presided as chairman of the medical meeting. Two papers were given. Capt. C. J. Roulston speaking on "Closed treatment of compound wounds", and Capt. A. Caldwell, speaking on "Complications and treatment of scarlet fever".

First showing of the cancer film won high approval from doctors attending the medical assembly. The film in colour, with an accompanying sound track, was the work of Evely Spice and Lawrence Cherry, Regina. Miss Spice won honours in London, England, for her distinctive documentaries before the war. Since returning to Canada, Miss Spice has directed several fine films, camerawork by Mr. Cherry.

Hon. J. M. Uhrich introduced the cancer film showing, and Dr. H. C. George, Regina, medical director of cancer services for Saskatchewan, was film commentator. The film describes the work of Regina and Saskatoon cancer clinics, showing doctors performing an operation, laboratory work, the application of x-rays and radium and other absorbing details.

After the scientific meeting, a game supper was served. H. D. HART

General

Canadian Association of Radiologists.—The mid-winter session of the Eastern Section of the Canadian Association of Radiologists will be held in Hamilton, Ontario, on January 3, 4, and 5, 1943.

The convention headquarters will be in the Royal Connaught Hotel. The business session will be held in the Mural Room on Sunday, January 3rd, at 8.30 p.m. Dr. E. H. Shannon, chairman of the Radiological Section of the Ontario Medical Association has called a meeting of this group for Sunday afternoon, January 3rd, at 3.00 p.m.

The directors of the Ontario Institutes of Radiotherapy will meet on Monday morning, January 4th, at 9.00 a.m. A symposium on the Diagnosis and Treatment of Cancer of the Oral Cavity will be presented. Members of the Association are invited to attend.

The program will include the presentation of a number of short concise practical papers on superficial therapy, to include the treatment of gas gangrene, plantar warts, sinus disease, basal cell carcinoma, and soforth. A series of short case reports on lesions of bone will be arranged. These will emphasize the differential diagnosis, final diagnosis, and pathological findings.

Restrictions on the Use of Quinine.—The following order has been received from the Controller of Chemicals, dated October 1, 1942.

Pursuant to the powers vested in the Controller of Chemicals by Order in Council P.C. 4996, dated July

A Real Advance

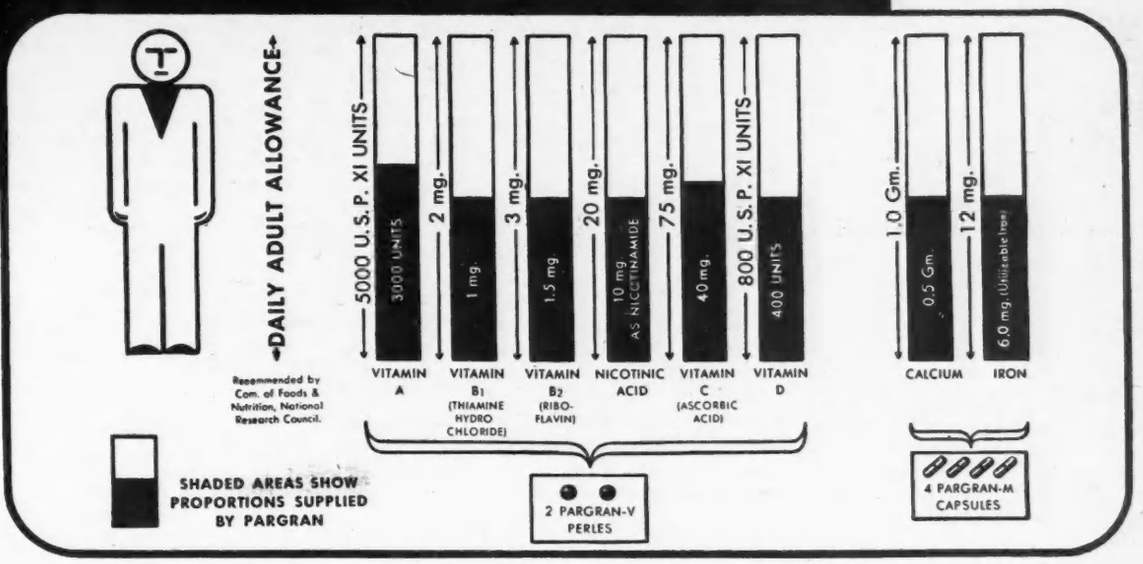
IN THE FIELD OF NUTRITION

PARGRAN-V

(Squibb Multivitamin Perles)

PARGRAN-M

(Squibb Calcium-Iron Capsules)



GOVERNMENT authorities estimate that the chances are three to one against the average family getting enough of the foods that are needed for the efficiency and stamina upon which our success depends. There is need then, for a balanced vitamin-mineral supplement for use where food sources are inadequate.

Based on the new trend in multivitamin and mineral therapy, the House of Squibb provides Pargran-V and Pargran-M—two products which, as shown on the chart—

- supply in proper balance the vitamins and minerals most generally lacking in the diet;
- embody the recommendations of the Committee on Food and Nutrition of the National Research Council, U.S.A.;
- afford flexibility of dosage—supplying vitamins or minerals or both—in ¼, ½, ¾ or the full recommended daily allowance;
- provide the advantages of convenience and economy.

Write now for complete information about Pargran-V and Pargran-M and for the new authoritative booklet, "Practical Nutrition." Address 36 Caledonia Rd., Toronto, Ontario.

E·R·SQUIBB & SONS OF CANADA, Ltd.

MANUFACTURING CHEMISTS TO THE MEDICAL PROFESSION SINCE 1858

10, 1941, and by any other enabling Order in Council or Statute, and with the approval of the Chairman of the Wartime Industries Control Board, I hereby order as follows:

1. *Interpretation.*

For the purposes of this Order, unless the context otherwise requires:

(*a*) "Anti-malarial Agent" means any product which is recognized as a specific for the prevention, alleviation or cure of malarial affections;

(*b*) "Consumer" means any person who buys, acquires, or accepts delivery of Quinine for his own or his family's use or consumption only, and not for the purpose of selling, giving in exchange or otherwise disposing thereof to any other person;

(*c*) "Controller" or "Controller of Chemicals" means the person appointed Controller of Chemicals by the Governor-General in Council, and for the time being in office as such;

(*d*) "Person" includes partnership, corporation, company, any governmental or municipal body or department, and/or any aggregation of persons;

(*e*) "Physician" means a person registered as a medical practitioner and in good standing under the Act or ordinance governing the practice of medicine and surgery within the province or territory wherein is tendered any prescription or order bearing his signature;

(*f*) "Retailer" means any person who, in the ordinary course of business, sells goods to the consumer and not for the purpose of re-sale, and includes hospital, dispensary and/or physician;

(*g*) "Wholesaler" means any jobber, broker, or other distributor selling otherwise than at retail;

(*h*) "Quinine" means Quinine and all other Alkaloids and their derivatives extracted from Cinchona Bark (Cinchona Succiruba P. et K; Calisaya. W; C. Ledgeriana M. et T.) also known as Calisaya, Peruvian or Jesuit's Bark, or from its hybrids;

(*i*) "Quinine Compound" means any mixture of several ingredients, one of which is Quinine, in fluid, pill, tablet, capsule, or any other form.

2. *Quinine Compounds.*

No person shall use Quinine in the making of Quinine Compounds except pursuant to an order or prescription signed and dated by a physician, or under a permit in writing from the Controller.

3. *Sale and Delivery of Quinine.*

No person shall sell or deliver Quinine, except

(*a*) to a consumer, who has, to the knowledge of the seller, been using Quinine as an anti-malarial agent, and the seller believes that such consumer will use the Quinine sold to him for such purpose; or

(*b*) upon a written order or prescription signed and dated by a physician; or

(*c*) to a wholesaler for resale only; or

(*d*) to a retailer for sale in accordance with subsections (*a*) and (*b*) hereof; or

(*e*) under permit in writing issued by the Controller.

4. *Sale of Existing Quinine Compounds Authorized.*

Nothing in this Order shall apply to or affect the sale or delivery of any Quinine Compound, which is mixed and ready for sale at the date of this Order.

5. *Reports.*

Every manufacturer of Quinine Compounds (other than a retailer) and every wholesaler shall, forthwith after the date of this Order, file with the Controller a report in writing stating separately the quantity of Quinine and Quinine Compounds in his possession.

E. T. STERNE,
Controller of Chemicals.

Drafting of Eighteen Year Old Youths

[Although there has been no questioning in Canada of the desirability of drafting youths of 18 for military service, it is felt that the following "open letter" will be of general interest to our readers. ED.]

"So much has been said and so much implied about the desirability of drafting 18- and 19-year old men for military service from the viewpoint of emotional stability that it seems that in the public interests that a simple, direct statement should be made on this question.

"Speaking as individuals, we wish to assure the public and parents of this age-group that there are no grounds for apprehension as to the effect of military service on these younger men as distinguished from the older men. Such statistics as are available indicate that the incidence of mental breakdowns is no greater in the 18 and 19 year age group than in the older group. If anything it is somewhat less. It would seem to us that the proposal now before the American Congress does not unduly compromise the future mental integrity of this particular age-group or of the nation. With the government realizing and properly assuming this increased responsibility, we endorse favourable action upon the proposal to include men of 18 and 19 years under the Selective Service Act."

Signed:

Adolf Meyer, M.D., professor emeritus of psychiatry, Johns Hopkins University, Baltimore, Md.

C. Macfie Campbell, M.D., professor of psychiatry, Harvard University, Cambridge, Mass.

Foster Kennedy, M.D., professor of neurology, Cornell University, Utica, N.Y.

C. Charles Burlingame, M.D., psychiatrist-in-chief, Neuro-Psychiatric Institute, Hartford, Conn.

Edwin G. Zabriskie, M.D., professor of clinical neurology, Columbia University, New York, N.Y.

Winfred Overholser, M.D., supt., St. Elizabeth's Hospital, Washington, D.C.

S. Bernard, Wortis, M.D., professor of psychiatry, New York University, New York, N.Y.

Tracy Putnam, M.D., professor of neurology, Columbia University, New York, N.Y.

Oscar Diethelm, M.D., professor of psychiatry, Cornell University, Utica, N.Y.

Finney-Howell Research Foundation, Inc.—Announcement has been made by the Finney-Howell Research Foundation, Inc., that all applications for fellowships for next year must be filed in the office of the Foundation, 1211 Cathedral Street, Baltimore, Maryland, by January 1, 1943. Applications received after that date cannot be considered for 1943 awards, which will be made March 1, 1943.

This Foundation was provided for in the will of the late Dr. George Walker, of Baltimore, for the support of "research work into the cause or causes and the treatment of cancer". The will directed that the surplus income from the assets of the Foundation together with the principal sum should be expended within a period of ten years to support a number of fellowships in cancer research, each with an annual stipend of two thousand dollars, "in such universities, laboratories and other institutions, wherever situated, as may be approved by the Board of Directors".

Fellowships carrying an annual stipend of $2,000 are awarded for the period of one year, with the possibility

EPINEPHRINE PREPARATIONS

- EPINEPHRINE is the name specified by the regulations under the Food and Drugs Act of Canada for the pressor principle of the adrenal gland and is employed to raise blood pressure, as a heart stimulant and in the treatment of bronchial asthma.

EPINEPHRINE is prepared in the Connaught Laboratories as a pure crystalline compound from beef adrenal glands. Each lot is assayed for potency in terms of the Government standard and is tested for stability.

- THREE preparations are made from the crystalline product in the Connaught Laboratories:—

1. **EPINEPHRINE HYDROCHLORIDE (1:1000)**

   Issued as a sterile solution in 30-cc. rubber-stoppered vials, to be given by injection.

2. **EPINEPHRINE HYDROCHLORIDE INHALANT (1:100)**

   Distributed in special dropper bottles containing 6 cc. Used as an inhalant in the treatment of bronchial asthma.

3. **EPINEPHRINE IN OIL (1:500)**

   Supplied for injection as a suspension of Epinephrine in oil in 20-cc. rubber-stoppered vials. For use when a prolonged effect is desired.

CONNAUGHT LABORATORIES
UNIVERSITY OF TORONTO
TORONTO, CANADA

of renewal up to three years; when deemed wise by the Board of Directors, special grants of limited sums may be made to support the work carried on under a fellowship.

Applications must be made on the blank form which will be furnished by the Secretary or any member of the Board of Directors.

October 1, 1942.

Book Reviews

Intention and Survival. T. G. Hamilton. 292 pp., illust. $4.00. Macmillan, Toronto, 1942.

This is a very unusual book by a Canadian surgeon who was actively interested in the problems of psychic research, which he carried on from 1918 until his death in 1935. In the introduction and a chapter on the background of metapsychics there is presented an excellent review of the more recent developments in this field. The main part of the book is concerned with a detailed description of experiments in psychic research carried on in the author's home over a period of many years. These experiments, which were concerned with an investigation of so-called teleplasm and other spiritistic phenomena, are recorded in detail and are illustrated by numerous photographs. The results of these investigations led Dr. Hamilton to believe that through certain mediums and so-called psychic personalities it is possible to detect an intention and ever-present desire on the part of certain individuals to indicate their continued existence following death. This book should be of special interest to those who are concerned with the nature and significance of the phenomena reported by various investigators in the field of psychic research.

Civilian Health in Wartime. F. R. Dieuaide. 328 pp. $2.50. Harvard Univ. Press, Cambridge, Mass., 1942.

Dr. Dieuaide's treatment of this subject makes this book readable both by employed personnel in the public health field and those without professional training to whom one looks for leadership in all matters of physical and social well-being. Of particular interest are those sections which deal with nutrition. His explanation of factors which motivate people's eating habits is probably as correct an interpretation by inference as could be presented.

The chapter dealing with the health problems of those in the older age-groups as they are affected by war is both timely and topical. Most of our wartime enthusiasm is directed to health measures designed to improve the physical status of children and adolescents. There has been a general lack of appreciation of the significance of maintaining at the highest possible level the well-being of the very substantial cross-section of the population between forty-five and seventy years. Equally apt is his treatment of the less tangible but nonetheless important phase of civilian health in wartime, commonly described as maintenance of individual and group morale.

This book is well written, informative, and might rightly find a place in the library of anyone directly or indirectly concerned with the health of any or all of the people in wartime.

Pain. Sir Thomas Lewis. 187 pp. $3.35. Macmillan, Toronto, 1942.

This book represents an attempt to evaluate the more modern views of the mechanism of the perception and localization of pain. It is written in considerable detail from the standpoint of pure science and is a book for advanced reading. However, the physician will find the ideas expressed with respect to certain clinical conditions, such as, the hyperalgesic state, ischæmic pain as in angina pectoris and Raynaud's disease, and referred pain, both informative and constructive. Perhaps too little time is devoted to the summarization of the author's conclusions.

The Modern Treatment of Venereal Diseases. E. T. Burke. 106 pp. 12s. 6d. John Bales & Staples, London, 1942.

The object aimed at in this volume is to provide the reader with such information as will enable him to treat persons suffering from venereal disease, in particular syphilis, in a thoroughly modern, efficient and adequate manner. Although mentioning other methods, the measures recommended are those which are in operation at Whitechapel Clinic, London.

The most important chapters are those which deal with the criteria of cure and the evaluation of anti-syphilitic therapy. The author has evolved a method of evaluating therapy which he calls an "efficiency index" of treatment. He has devised a therapeutic unit based on the chemotherapeutic index in animals as affected by its efficiency ratio in man. This efficiency index is then calculated as the number of therapeutic units x 100 divided by the number of weeks of treatment. According to his figures, a cure rate of 100% is obtained in normally reacting males with early syphilis if the efficiency index figure for the treatment is 60 or over. He goes so far as to say that the efficiency index is the all important thing and will even advise marriage without a probationary period as soon as the treatment schedule is finished.

The final chapters in the book are devoted to the treatment of gonorrhœa in its various forms, both in the male and the female.

In view of the present marked increase in the incidence of venereal disease, a handbook of this nature should be part of the medical library of every medical practitioner.

A Handbook of Allergy for Students and Practitioners. W. B. Blanton. 190 pp., illust. $3.00. Chas. C. Thomas, Springfield, Ill., 1942.

The author states that this book was written to supply "A brief but inclusive test, to be supplemented by conference, quiz, and clinical demonstration". He has accomplished this admirably. The matter is presented with almost telegraphic brevity, unusual clarity, and a crisply logical and orderly arrangement. His subject, moreover, is adequately covered, though not covered completely.

That a Professor of Medicine has been willing to write a textbook on allergy is perhaps a milestone in the history of this subject, a sign that allergy is becoming, or has become, respectable. Nevertheless the fringes of allergy are heavy with the dust of doubtful matter. Professor Blanton contrives to include much of the questionable material by introducing it with the phrase "So and So states that. . . ." Thus deftly dodging the responsibility himself. The reader should be warned to recognize this stratagem and read with discrimination.

The book covers the general principles of allergy, allergens severally and by classes, hay fever, allergic rhinitis, asthma, dermatologic allergy, gastro-intestinal, and "other allergies". There are also appended wheat-, meat-, and egg-free diets, and a table showing strengths of various materials suitable for routine patch testing, and directions for preparing and maintaining a "dust free" room.

This is a book that any medical student, general practitioner, or internist may read with profit. As the basis of a course of lectures for students it approaches the ideal. The reviewer respectfully suggests it be considered "required reading" for all Professors of Medicine.